SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLVIII.—No. 20. [NEW SERIES.] NEW YORK, MAY 19, 1883. [$3.20 per Annum [POSTAGE PREPAID.]

RAIL ROLLING MILL ENGINES.

Our engraving illustrates an engine constructed by Messrs. Davey Brothers, Limited, of the Park Iron Works, Sheffield, for the rail mill of the Tredegar Bessemer Works. The figure shows the reversing cogging mill engines. The cylinders, which are overhung, are 40 inches in diameter and 5 feet stroke, and are fitted with balanced slide valves, worked, through reversing links of the Allan type, by eccentrics fitted to separate shafts and driven by drag links from the main cranks. The reversing is effected by a steam cylinder fitted with suitable controlling gear, so arranged as to dispense with the usual oil cataract. All the starting handles are brought to an elevated platform erected over the center of the engine, so that the man in charge has a complete view both of the engine and of the rolls.

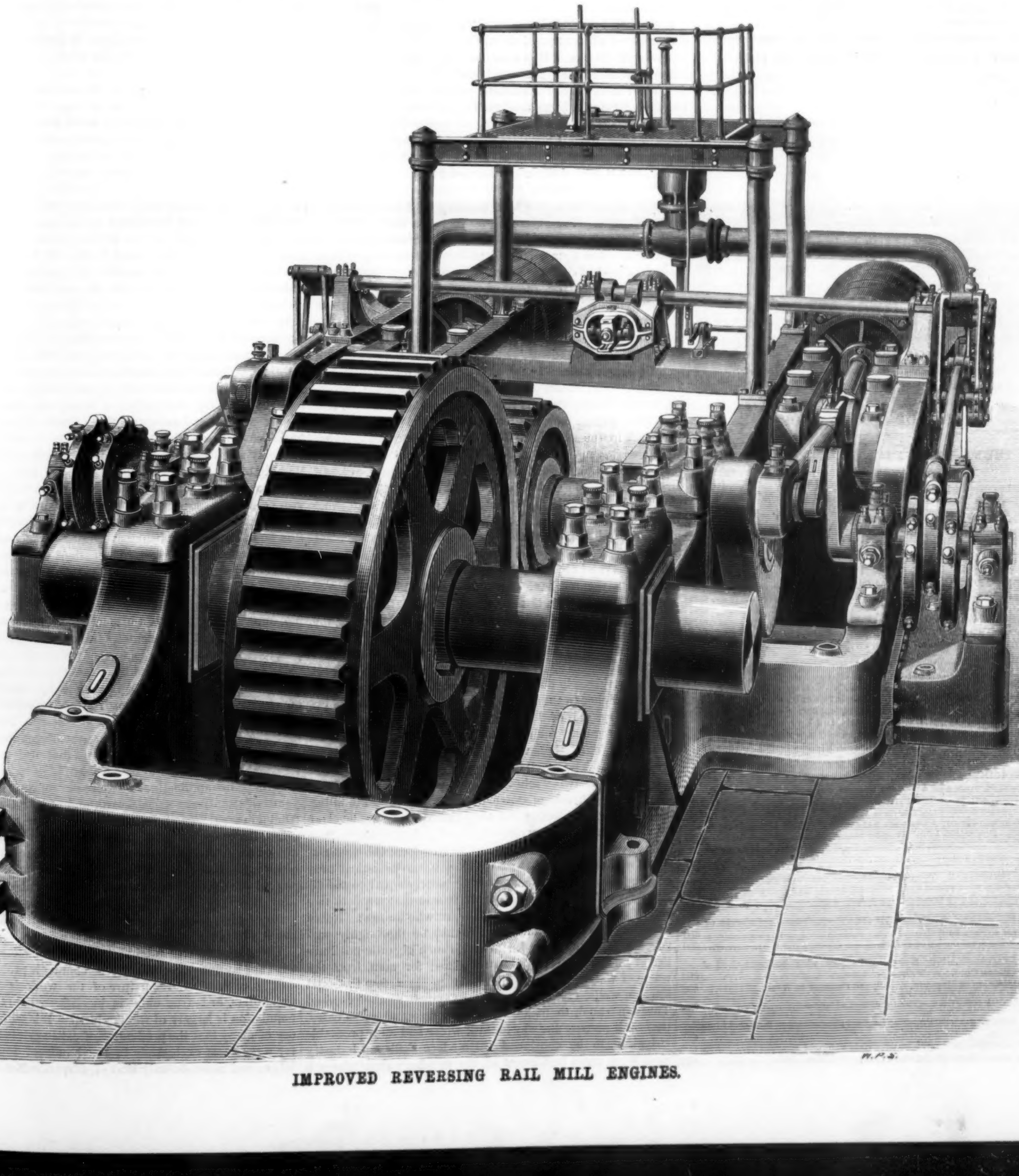
The cranks are of cast steel and have the counter weights cast on. The crankshaft is of best wrought scrap iron, 16 inches in diameter in the journals and 20 inches in the middle. The second motion shaft is also best wrought scrap iron, 20 inches in diameter in the bearings and 24 inches in the middle. The spur gearing has a ratio of about 2 to 1; it is 8 inches pitch and 24 inches wide at the points of the teeth. The total weight of the engines is about 140 tons. We may state that a modern rail plant, consisting of cogging, roughing, and finishing engines and mills, will turn out 3,000 tons of rails per week with ease, while formerly 700 to 800 tons was considered a splendid week's work.—*Engineering.*

Resistance on Railway Curves.

At a recent meeting of the Institution of Civil Engineers, it was stated by Mr. John Mackenzie that when a six-wheeled engine with parallel axles was running round a curve, the tendency which the outer leading wheel flange had to mount the rail was evidently caused by its adhesion to the side or rounded corner of the rail, and that this adhesion was the result of a side pressure which, at low speeds, was principally caused by the resistance the treads of the wheels offered to the sliding motion that took place in going round a curve.

He contended that this side pressure increased with increased adhesion of the treads of the wheels to the rails, and that the adhesion of the flange itself to the rail also increased with the increased ratio of adhesion, so that the tendency of the flange to rise increased in something like the duplicate ratio of the fraction representing the coefficient of adhesion. As the point of contact between the flange and the rail was in advance of the center of the axle, the motion of the flange at that point was downward, imparting a downward pressure to the rail, and an upward pressure to the wheel, so that when the flange adhered to the rail the wheel rose.

Thus the pressure which would cause the flange to mount the rail was not that which, with the wheel at rest, would force it over the rail in opposition to friction as well as to gravitation, but the very much smaller pressure which, when the wheel was at rest and the tread raised slightly above the rail, would cause friction sufficient to prevent its falling into its place again. It had been found by actual experiment that the adhesion between wheels and wet rails with sand sometimes rose above 40 per cent of the weight; and it might be found, by calculation, that with this proportion of adhesion the side pressure on the flange of the outer leading wheel of many six-wheeled engines of not unusual proportions might, under certain circumstances, be so great as to cause the flange to adhere and mount the rail; and that, as regarded running off the rails, six-wheeled engines generally had a very narrow margin of safety.



IMPROVED REVERSING RAIL MILL ENGINES.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 261 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, MAY 19, 1883.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 885,

For the Week ending May 19, 1883.

Price 10 cents. For sale by all newsdealers

THE PROPOSED SEA OF SAHARA.

The project for inundating the Desert of Sahara, and thus changing it into a new oceanic empire, is the most astonishing of all the gigantic enterprises of the age. We are inclined to favor it because of its very boldness and grandeur. Since it was first brought out, in 1877, by M. De Lesseps in the French Academy of Sciences, scarcely a word has been spoken against it, although its originator admits that its execution will require the services of an army of at least 100,000 workmen, and an outlay of not less than $30,000,000.

A reasonable protest has at last appeared, from the pen of Mr. R. W. Wright, published in the New Haven *Journal and Courier*, the main points of which are worth considering. Conceding that M. De Lesseps is to be recognized as a great and successful civil engineer, it is denied that he is wise enough to tell whether half a continent had better be submerged, and the climate of the globe materially changed. The mere fact that the daring French engineer succeeded in cutting the Suez Canal, thus making a valuable commercial highway, does not prove that he had better flood the great African desert. He has demonstrated the possibility of digging a canal through Tunis from the Mediterranean Sea, but he has failed to give any reliable topography of the vast desert that is to be thus changed into an inland sea, nor has he suitably informed us what compensating advantages the civilized world is to gain in place of certain positive benefits accruing from the existing state of things. Among the latter, Mr. Wright mentions the following:

1. The existing desert is "a great radiator of heat, many times greater in fact than the Gulf Stream." It operates, like that oceanic current, to force the "thermal equator" northward, and to change it as proposed would affect the mean temperature of all Europe, and might seriously modify its area of civilization.

2. The desert acts "as a great aerial sponge," absorbing atmospheric moisture over a wide and rainless region, and thus ameliorating the climate of a large portion of the Eastern hemisphere.

3. This vast sand plain acts as a "storm barrier," arresting and breaking up the tornadoes on their way from the tropics to devastate Europe. It is a mistake to suppose these destructive winds to be generated amid the solitudes of the desert. The cause of the simoom, which often takes on the alarming form of a huge sand spout, is the fact that when a tornado strikes the desert it begins at once to lap up the particles of sand, until it has thus gathered into itself thousands of tons, which finally load it down beyond its carrying power, and it falls with its burden and finds it fury spent.

4. The sands of Sahara act as a great "absorbent of malaria," thus preventing the fatal maladies of Africa from invading Europe. The desert is known to be absolutely free from malaria, for the good reason that it contains nothing to produce it. The equatorial regions south of the desert breed the most dreadful diseases known on the globe. Substitute an inland sea for the waste of sand, and the pestilential winds would sweep more swiftly across to precipitate their plague-germs on the population of Europe.

5. Mr. Wright's greatest objection to the project is that it would create a "dead sea," similar to that of Palestine, only on a far larger scale. There would be an artificial inlet, but no outlet. The waters would be hopelessly stagnant, receiving no fresh water streams from the African watershed, and out of the way of the oceanic currents. The Tunisian canal would let in the salt water from the Mediterranean, which would become more and more briny by constant evaporation, increased further by the extensive natural deposits of salt already known to exist in portions of the desert. The inevitable result would be the creation of a lifeless, terrible waste of dead waters, environed by dreary salt hills and dismal marshes like those that now surround the site of ancient Sodom.

To these valid objections must be added certain considerations as to the mechanical action of an immense body of water rushing in from the Mediterranean Sea to deluge the far lower regions of the Sahara. De Lesseps reports the highest parts of the great desert as being about 1,300 feet above the sea level, and other spots as being more than 1,000 feet below it. He also finds sand, sand everywhere, without any rocky ridges to hold in check the mighty rush of water from the higher to the far lower level whenever it shall begin. No system of locks can be constructed sufficiently strong to regulate such a formidable deluge, especially as their sandy foundations would be liable at any moment to be swept away. The inevitable result would be the filling, not only of one or two "schotts," or dry basins, as now proposed, but the breaking down of all barriers and the filling of all the series of basins, till they had risen to the level of the Mediterranean reservoir.

The vastness of this region can be seen from the measurements of Von Steinwehr, who makes its geographical area 3,000 miles long and 800 miles wide, nearly equal to the dimensions of the United States. It is said that not half this desert region would be flooded—but who knows? It has been imperfectly explored, and should be thoroughly surveyed before tampering further with such gigantic possibilities of mischief! Nature has reclaimed for man, from the waste of waters, a region that only needs a few thousand artesian wells, not costing near as much as the proposed Tunisian canal, to make an equal number of green oases, that shall prepare the way for still wider and more profitable irrigation, to be continued till modern skill and industry shall work out a fulfillment of the prophecy that "the wilderness shall blossom as the rose." This beneficent scheme may not be applauded by the French Academy, but it has the prosaic merit of being safe; it would require no greater expenditure of funds than its practical results would warrant; nor would it encounter more serious hinderances than the ancient Egyptians overcame in making the sandy valley of the Nile the garden of the world.

APPRENTICES TO MECHANICAL TRADES.

The opinion appears to be spreading that fewer opportunities are given boys to learn mechanical trades then formerly, and that the number of boys who desire to learn to be skillful mechanics is constantly lessening. In a hearing before a legislative committee in a New England State, a few weeks ago, it was testified that while formerly it was the desire of boys to enter on a mechanical apprenticeship, the contrary was now the fact, one witness saying that the boys all aimed to get positions in insurance offices, and another expressing the belief that the future supply of mechanics' apprentices must come from the State reformatory institutions. Another gentleman of acute observation said that "the growing tendency of the times is not to have boys learn a trade. The old system of apprenticeship is no longer in vogue. The trades seem to be despised."

Other statements have been published to the effect that our skillful mechanical work is fast passing into the hands of foreign-taught mechanics, and that Americans are becoming scarce in mechanical establishments. It is asserted, also, that labor unions, introduced and sustained by foreigners, discourage the reception and education of apprentices in the shops, and that they have so great an influence as to materially change the constituents of shop labor.

It is possible that all these statements are drawn from a condition of things that is limited if not isolated, or they may be assertions made on general grounds, without particular circumstances to give them authenticity. It is certain that if these conditions do exist at any one point, they are not general and common. If the intelligent observer will visit a number of our first-class mechanical establishments, he will ascertain that a fair proportion of the employed are apprentices and learners—as large a proportion as can be employed to advantage. A single example may be cited—only one of many.

One of the officers of a large mechanical establishment, whose products are sent all over the civilized world and whose name insures excellence, if not superiority, of production, stated recently that the company employed as large a number of apprentices as the nature of their work would permit, from economical reasons, among others—they were generally a source of profit. The system is to take the apprentice on probation under certain conditions. If, after sufficient trial, it was found that the apprentice had no mechanical bent or lacked in the natural qualities to become a good workman, he was allowed to go. If, however, he and his work agreed, the permanent arrangement was made. The terms are 70 cents per day for the first year, 80 cents second year, 90 cents third year, and $1.20 the fourth year. As a bond for faithful performance of contract, the apprentice deposits $100, to be held until the termination of his apprenticeship, and to be forfeited if he refuses to serve his full time. Usually this deposit takes the form of a retention of $8.50 per month from the first year's wages. Apprentices received after the completion of twenty-one years begin on the second year and serve only three years, subject, however, to the same bond.

It may sound strange to hear of an applicant for apprenticeship of the age of twenty-one years, but applications have been made at this establishment by men above thirty years old. To show that the desire to learn a trade is not extinct among our boys, it may be stated that the application book of this establishment contains the names of not less than one hundred and fifty patient waiters, and these were culled out of probably as many as five hundred applicants. The apprentices received here have the opportunity to learn either the moulding (foundry) business, pattern making, or any department of the machinist work, their tendency to any division of the machinist trade showing itself as they progress.

It requires no assurance of the fact to convince one of the profit of apprentice work to the company under these circumstances, and no logic to prove that refusal of opportunities to learn a trade would be poor policy. And the fact that the numbers offering as apprentices are ten times greater than the opportunities shows that it is not *generally* true that "trades seem to be despised."

Perhaps the applications of those of the somewhat mature youth of twenty-one and upward, and of thirty years, comes from an experience of the disadvantage of no trade.

The high reputation of the establishment which has been quoted as an illustration may account for the large number of its applications, but the proprietors of small shops have said, lately, in reply to questioning on the subject of apprentices, that they are never at a loss to find candidates for apprenticeships, and are able to make a selection from a number at all times.

The statement that foreign taught mechanics are gradually supplanting American bred mechanics is probably correct only in cases where the nature of the work is foreign and unfamiliar, or is true only in localities where the working population is largely of foreign birth. It is within the memory of many that the production of calico prints in this country was almost exclusively in the hands of foreign taught labor; and more recently that of carpets. But the careful,

unprejudiced, and disinterested observer will find no facts to warrant the fear that the race of American mechanics is in danger of becoming extinct, either because there are no more boy mechanics, or that they are refused opportunities.

THE SOCIETY OF AMERICAN TAXIDERMISTS.

The exhibition of the Society of American Taxidermists, which was held in this city during the week ending May 5, was less notable for its general excellence than for the effects which it is likely to have on the taxidermy of the future.

An example of what can be done in the right direction was shown by Professor Ward, of Rochester, who had a group of duckbills (*Ornithorynchus paradoxus*). This is one of the least known of the mammalia, and yet it was impossible for a child even to look at the group without gaining a very good general idea of the creature's habits. The house was shown; the peculiar manner of curling up the body in sleep was given; the act of grubbing under water for worms was portrayed; and indeed, by taking a half dozen or more of the creatures, their principal characteristics were made clear. And incidentally a glimpse was given of the character of Australian plant life.

The most perfect work in the exhibition was beyond doubt the elephant Mungo, belonging to the Smithsonian Institution. This was mounted by Mr. Hornaday, and as a specimen of the taxidermist's art is superior to anything yet done, in this country at least. The elephant, which is of the African species, stands about five feet high, and it does not seem as if the original flesh and blood Mungo could have been more lifelike.

Mr. Hornaday, who has shown himself an artist as well as taxidermist, insured a correct beginning by modeling the limbs and other principal bones in wood from the skeleton. The wooden frame was wound with tow, and the whole covered with chopped tow and potter's clay to a depth of one and a half to two inches. With this plastic substance he was enabled to simulate the numerous lumps and hollows so plentifully bestowed on the elephant's body; and, moreover, the same substance in hardening made a practically indestructible body.

There was a good exhibit of plaster models by Mr. Kemys, the best of which was a puma in the act of moving stealthily along. The head might have been better done, but the pose of the body was well caught. A raccoon, too, was particularly well executed.

Birds there were in plenty, and among them the long suffering owl posed in all the natural and unnatural attitudes which the fancy of man could suggest. The most artistic of the bird pieces was a wounded heron, by Mr. Webster, of Rochester. The bird, in its death agony, is endeavoring to pluck out the arrow which has pierced it. Another very good specimen was a fight between two hawks, in which by a simple but ingenious device one of the birds is made to hover in the air without any immediately apparent support. This group, by the way, is not a recent work. A frightened owl with ruffled feathers, by Mr. Wallace, was among the best of the birds.

There were several good dogs, but the best was a really wonderful work by Mr. Hornaday—a hairless Mexican terrier. This dog, which was equal in merit to the elephant, was passed over by the judges in consequence of an impression that it was a plaster cast. Certainly a tribute to the excellence of the work.

There were a number of very fine plaster casts, notably the head of a domestic calf and a dolphin's head, by Joseph Palmer, and the head of a leather-back turtle, by William Palmer.

Taken as a whole, the exhibition was far superior to any hitherto held, and the evident endeavor shown in the work to rise out of the rut in which taxidermy has been running was cheering to those who hope for something more than stuffing from the art.

AN UNWELCOME TRUTH.

Under the above title the *Journal of Science* for April, 1883, contains a brief account of some of the results of M. Deherain's investigations in France into the impoverishment of soils under cultivation.

The facts elicited by these examinations prove that "the amount of plant food removed from arable land by the crops is neither the whole, nor in many cases the greater part of the yearly loss," at least as far as combined nitrogen is concerned. In other words, that the amount of inorganic material assimilated by the plant from the soil does not represent the actual loss of the same soil under one year's cultivation. To a small degree this discrepancy had been assumed before, and accounted for by the solubility of some parts of the manures and the volatilization into the air of other portions.

M. Deherain's experiments were made upon land divided into plats, some of which were enriched with farmyard manure, others with sulphate of ammonia or soda saltpeter, and others were left unmanured, and all were planted with maize and potatoes for seven years in succession. The results proved a loss of nitrogen much greater in all cases than could be accounted for by the amounts appropriated by the crops; that the loss of the plats enriched with the soluble salts was the greatest, and that of the plats dressed with farmyard manure least; that the more plentiful the manuring the greater the loss, and that these losses of nitrogen ceased when the land was no longer subject to yearly cultivation, but was converted into an artificial meadow.

The inferences are unmistakable. Solubility of manures increases their loss, drainage, and underground soakage, removing them in proportions directly relative to their amount; also cultivation, involving the opening of the ground and consequent exposure of the oxidizable portions of the manure to access of air, increases the nitrates, which being soluble are carried with every shower. The use of manures with the least proportion of soluble salts, but which may yield this necessary pabulum of the plants by slow change, and alternations of crops, by which overworked fields, that have been too long exposed to the depauperating influences of oxidation and drainage, may recover their original fertility, seem methods that may partially help to avert the threatened disaster of constantly deteriorating lands.

Future of Machinery.

The following hints from the *Mechanical World* (London) are intended, of course, for the British manufacturer, but they are none the less worthy the attention of our own engineers and machine builders. Notwithstanding the great perfection attained by our manufacturers of wood and metal-working machinery, in which sphere no country excels our own, there is still room for advancement, and this very success should serve as an incentive to further improvement and still greater energy in introducing our machinery abroad.

If there is one fact more patent than another, it is that there is a wide field and an important future for machinery. We find that almost every engineering works throughout the country is fairly busy, that machine shops are springing up in all directions on the Continent, in the United States, and in our colonies, clearly showing that in the opinion of capitalists the machinery business is one which can be extended and will yield profits. Machinery and mechanical engineers are coming more to the front every day, and our leading representatives of the latter class now rank with the best of civil engineers. Time was when there was a jealousy between the two bodies, the "civils" calling the machinery men "the iron fellows," and the "mechanicals" alluding to the civils as "the bricks and mortar men." It is, however, a significant fact that nearly one-half of the members in the Institution of Civil Engineers are now mechanical engineers.

It is a complaint frequently made that our English representatives of manufacturers do not penetrate sufficiently into the interior of foreign countries to find out their exact wants. The miserable and insufficient manner in which foreign languages are taught in this country no doubt contributes largely to this serious omission. Let our manufacturers and mechanical engineers be a little more enterprising; send out their promising young men to inspect and report upon matters relating to their special trades. There is a kind of conservatism in old establishments which operates in keeping the young men down to routine duties until they become gray-haired, and until the love of travel is largely gone. We reported, only a few weeks ago, the visit of Mr. Abbott, the engineer of the Toronto Bridge Works, to this country and to the Continent for acquiring information as to English and Continental practice. We wonder whether such a step can be paralleled by any bridge-making firm in this country. Colonel Roden, of Lord Granville's ironworks in Staffordshire, sent out some years ago to Belgium and France one of his leading practical men to notice any improvements he met with, and from conversations we have had with the gentleman sent out, the company whom he represented were well paid for their enlightened policy. Although we boast of being the "manufactory of the world," we must not "rest upon our oars" and shut our eyes to what is going on in other countries. If an experiment is being made, we must watch it; if it succeeds, take advantage of it; and if it fails, be warned by it. We must stir up the spirit of enterprise. Where we make things by one and two we must make them by hundreds and thousands, adopt special machinery, and discover special markets. Our means of locomotion and transport enable us to reach foreign countries even more expeditiously than it brings the foreigners here. It is a known fact that yong engineers from France, Germany, and Russia are sent to this country to collect information. Sir John Brown's and Cammell's, of Sheffield, may be instanced as establishments which numbers of these inquirers visit from time to time. These works and a large number of others not less important have become show-places for foreign mechanical engineers, and from which they have derived much information, to our disadvantage, and it behooves us to cultivate a similar spirit of enterprise and observation. If we do this, the successful future to be looked for in connection with the machinery trade of this country will be still more certain.

Some of our manufacturers are very slow to adopt improvements, and are inclined to allow new inventions to lie dormant, leaving it to some more enterprising firm to make experiments with it. In the States, and even on the Continent, there is no such lack of energy. A new thing is readily tried; in fact, we believe it is usually liked all the better if it is new. Our engineers and machinists, and, indeed, every manufacturing class, adds the *World*, should therefore be on the alert, and look to their laurels. Too much apathy exists at present. Let us have energy, enterprise, and vigorous action instead.

AN excellent authority in medicine recommends a little common sugar as a remedy for a dry, hacking cough, and gives scientific reasons for it. If troubled at night or on first waking in the morning, have a little cup on a stand close by the bed, and take half a teaspoonful; this will be of benefit when cough sirups fail.

A Thunderstorm in New York.

On the morning of May 10, between 3 and 4 o'clock, a thunderstorm of remarkable violence passed over the city of New York and vicinity, doing enormous damage. A large building in 25th Street, occupied as a sash and blind factory, was struck by the lightning and destroyed by fire. A fine dwelling house just north of the city limits and on the west side of the Hudson River was struck and burned to the ground. A large schoolhouse on Staten Island was also struck, and badly damaged. A barn and contents, also a shop at Babylon, L. I., were also struck and destroyed.

At the works of the National Docks and Storage Company, on New York Bay just southwest of the city, fearful havoc was made. Here there were 27 large tanks for the storage of oil, built of brick but cased with iron outside, and covered with heavy iron tops. The lightning played around the tanks for some time, as if specially attracted to the vicinity; at length, with a deafening roar, a tremendous bolt fell upon tank number 11; it was instantly followed by an earthquake-like explosion, and a sheet of flame shot up into the air a thousand feet high. The tank burst into thousands of pieces, the burning oil was scattered in all directions, and almost instantly the remaining tanks, warehouses, buildings, docks, vessels, railway cars, and everything pertaining to the establishment, which was of great extent, embracing several acres, were involved in common ruin. Six persons are known to have lost their lives. The cash value of the property destroyed is estimated at half a milliondollars.

Ordinary buildings may unquestionably be protected from lightning by the use of rods that are thoroughly grounded in the earth; but when it comes to the protection of an iron oil tank, we have a very different condition of things. The space within the tank, above the level of the oil, is filled with light inflammable gas, that goes off like powder, whenever the smallest spark of electricity appears; then again the air outside and near the tank is more or less charged with the gas. If, therefore, the outside of the tank should be struck by lightning, or if, as is doubtless often the case, there should be a stroke of lightning at some distance from the tank by which the electricity runs along on the underground piping to the tank, or if a spark is produced by induction between pipe and oil in the tank, then an explosion may take place. These points have been heretofore fully discussed in back numbers of the SCIENTIFIC AMERICAN, and various useful suggestions presented.

The Drag Rope for the Brooklyn Bridge.

The great driving rope which is to pull the cars across the Brooklyn Bridge has arrived at the wharf adjoining the Fulton Ferry from the J. A. Roebling Company's Wire Works, Trenton, N. J. It is 1½ inches in diameter, 11,709 feet long, and weighs 19 tons. It is accompanied by a duplicate rope of the same weight and strength, which is to be held in reserve for use when the first rope wears out. Col. William H. Paine, in speaking of it to a reporter of the *Eagle*, said: "In all my experience, I have never seen a rope to equal it in manufacture; for the wire seems to be perfect, and the test which it has been subjected to gives ample assurance of its strength. Before it left the works every wire held at least 1,000 pounds, and was stretched from four to six per cent more. The tarring observable on the surface is for the purpose of protecting it from the atmosphere, and also to give the interior a kind of lubrication when it comes to be used."

An Electric Underground Railway in London.

The underground electric railway, whose construction has been authorized by act of Parliament, will commence near the north end of Northumberland Avenue, opposite the Grand Hotel, and pass under that avenue and the Victoria Embankment to a tunnel under the Thames, thence by College Street and Vine Street to Waterloo Station, where it will form a connection with the platforms of the London and Southwestern Railway. A separate approach to the Waterloo terminus of the line will, however, be built at York Road. The line will be double, and worked by a stationary engine at Waterloo. The cars will run singly, and start as soon as filled, like omnibus cars. The journey will occupy about 3½ minutes. A contract for the supply of the electrical plant has been entered into with Messrs. Siemens Brothers, and a tender for the construction of the permanent way in eighteen months' time has also been accepted. Part of the work—about 60 feet of arching under the Embankment—has already been built.

Consumption of Gas in Berlin.

In the year 1881-82 the four gas works of that city produced 3,360,000,000 cubic feet of gas, of which 14¼ per cent was consumed in public illumination. The loss amounted to 8·2 per cent. Schlesian coal is almost exclusively employed and yields on an average ten thousand cubic feet of gas per ton. Over eleven thousand tons of coal tar were made, which sold for $99,143; also 24,300 tons of ammonia water, which sold for $81,946.—*Schilling's Journal.*

THE amount of light given out by a gas flame depends upon the temperature to which the particles of solid carbon in the flame are raised, and Dr. Tyndall has shown that of the radiant energy set up in such a flame, only the one twenty-fifth part is luminous; the hot products of combustion carry off at least four times as much energy as is radiated, so that not more than one hundredth part of the heat evolved in combustion is converted into light.

BEINS'S APPARATUS FOR THE MANUFACTURE OF CARBONATED WATERS.

Among the natural mineral waters, there are some that contain carbonic acid, and when these are exposed to the air the gas disengages itself, in part, in the form of little bubbles. Since very ancient times, these fluids, called *acidulated waters*, have been employed either because of their agreeable and refreshing taste, or on account of their medicinal properties. To this category belong the following waters: Seltzer, Fachingen, Appolinaris, Soulzmatt, Condillac, Kissingen, etc. The carriage and preservation of these waters are attended with great inconveniences; for, being often put up in badly corked bottles, they soon lose their gas and become insipid. It is for this reason that endeavors have been made for a long time past to imitate mineral waters in general and acidulated waters in particular. From the beginning of the sixteenth up to the end of the eighteenth century, attempts to attain such an end have been made by Van Helmont, Bergmann, Lane, Priestley, Lavoisier, Watt, and other illustrious scientists. But it was not till the beginning of the present century that chemistry and mechanics were sufficiently advanced to permit of a sufficiently exact analysis of natural mineral waters, and to construct apparatus for manufacturing them artificially.

The first apparatus of this kind was constructed about the year 1790, at Geneva, by Gosse, a pharmacist of French origin. The force pump had then been known for a long time, and had been utilized by Lavoisier; the gasometer had been invented by Watt; Bergmann had invented apparatus for washing gas by water; while the Duke de Choiseul had invented an arrangement for charging liquids with gas. By combining these different apparatus in a proper way, Gosse constructed quite a simple apparatus, which was set up in Paris in 1809.

Among the inventors who should be cited in the first rank for the progress made in the manufacture of carbonated waters is Frederick Adolphus Struve, who, after an assiduous labor of a dozen years, succeeded so well that artificial mineral water factories, as well as drinking stalls, were established in the principal cities of Germany, such as Dresden (1820), Leipzig (1822), Berlin (1823), etc. When the Asiatic cholera ravaged Paris in 1831 and 1832, the use of carbonated waters was generally prescribed by physicians, and the consumption rose to half a million bottles per year. From that epoch up to 1840, the annual consumption was two million bottles. In 1851, the consumption was estimated at five million bottles. In 1861, the Department of the Seine, containing a hundred factories, used 20,000,000, and the provinces 35,000,000 siphons. To-day, the consumption of carbonated beverages in the whole of France is estimated at 100,000,000 bottles and siphons, representing a cost to the consumer of 30,000,000 francs.

With the extension of the trade the apparatus for the manufacture of the waters have been improved, and now there is scarcely a town of any importance in the civilized world in which there is not a manufactory of these beverages. Other beverages, too, are charged in the same way with carbonic acid, and there are thus obtained carbonated lemonade, ginger beer, etc.

The apparatus employed at present for the wholesale manufacture of carbonated waters differ very much from one another, but may all be reduced to two systems: the continuous system, by mechanical compression, and the intermittent system, by chemical compression. Besides these, we may cite another method, which was invented a few years ago by Messrs. Ib & Beins, of Groningen (Netherlands), and which, under the name of the "Beins system," has since been considerably improved by its inventors.

This system differs in two capital points from all others. First, the carbonic acid is disengaged by the heating of carbonate of soda or vichy salt, which, from the mode in which it is prepared, is always very pure. Second, the water or other beverages that are to be impregnated with carbonic acid are saturated only in the bottles themselves with this gas, so that they do not come into any contact whatever with metal.

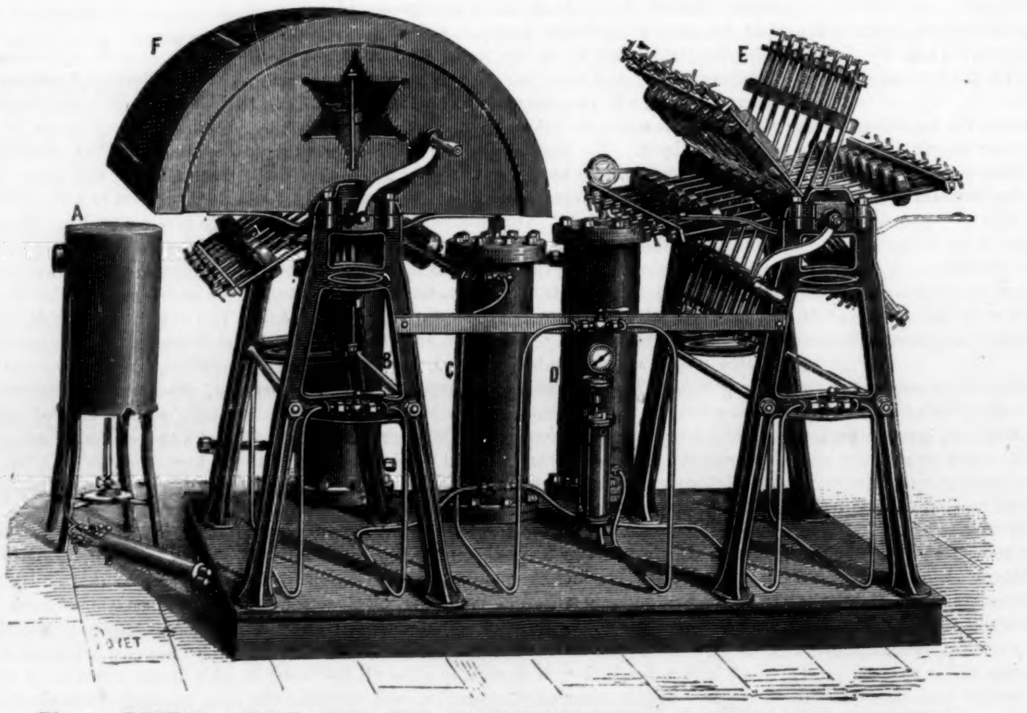


Fig. 1.—BEINS'S APPARATUS FOR MANUFACTURING CARBONATED WATERS.

Fig. 1 represents the Beins apparatus. To the left is seen a furnace, A, heated by a Bunsen gas burner, and containing an iron retort filled with powdered bicarbonate of soda. This retort is closed hermetically with a plug which carries a pipe through which the gas issues. The soda is decomposed by the heat into a carbonate, which remains in the retort, and into carbonic acid and aqueous vapor, which make their exit and traverse a Liebig refrigerator (represented at the lower part of the furnace).

The gas afterward passes into a solid, cylindrical vessel, which is shown between the two large cylinders to the right. The water derived from the decomposition of the bicarbonate collects in this, and is drawn off through a cock beneath. The carbonic acid is afterward led into one of the two large cylinders to the right or left, B and D, which may be put in communication by means of a pipe provided with a cock. These cylinders, which are of solid copper, are provided with pressure gauges, and are capable of withstanding a pressure of 30 atmospheres. When the apparatus is in operation, the gas therein is submitted to a pressure of about 15 atmospheres. In these two cylinders, as in the one in the center, C, there is placed recently calcined fine charcoal, which serves for removing from the carbonic acid all traces of any empyreumatic substances that have been produced by the decomposition of minute quantities of organic matters, such as filaments of wood, for example, that have been mixed by accident with the bicarbonate. The carbonic acid at high pressure is led from the two external cylinders, B and D, into the middle cylinder, C, by a pipe whose cock may be seen to the front of the figure. Into this cylinder it is made to pass under the pressure with which it is desired to charge the beverage, and which is generally 5 atmospheres.

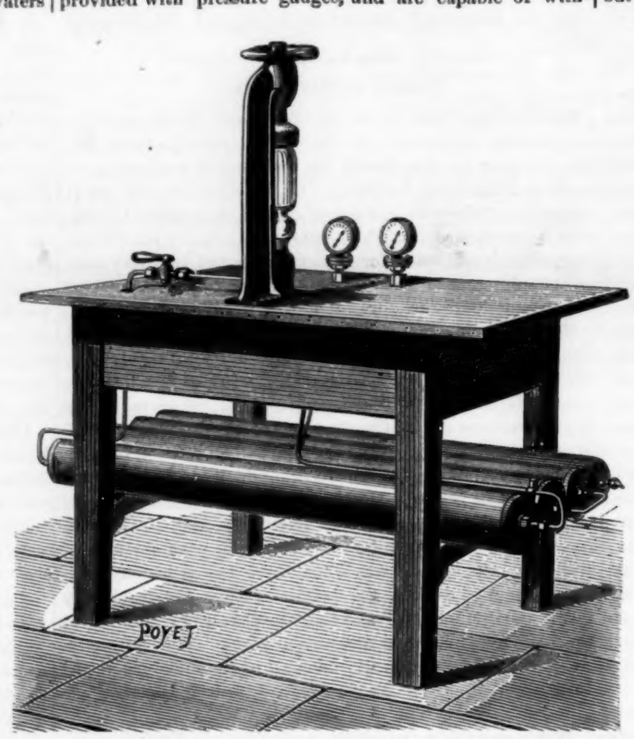


Fig. 2.—FILLING A BOTTLE BY THE BEINS METHOD.

The liquids which it is desired to charge with gas are first poured into ball flasks, one of which is represented inverted over the table in Fig. 2. The neck of this flask is provided in the center with a ball, and tapers beneath, so that the latter cannot drop into the flask itself. At its upper part the neck is thickened so that the ball may fit accurately, and its extremity is provided with a rubber ring fixed in an internal groove, which keeps the ball from coming out, and permits it to act as a stopper when the internal pressure of the prepared beverage drives it upward. When it is desired to empty the bottle, it is only necessary to push the ball down into the neck in order to give passage to the liquid. The carbonated water put up in these flasks must be used as soon as the latter are opened, and it is for this reason that they are made to contain only 300 cubic centimeters.

These ball flasks are fixed by screws to a hollow axis, E (Fig. 1), which is afterward revolved for about ten minutes in order to cause the absorption of the carbonic acid by the water.

The apparatus which we have just described are excellent ones for the production of gaseous beverages in a small way, but not for a wholesale production of them. As the consumption of artificial mineral waters is ever on the increase, Messrs. Beins have devoted themselves to the construction of some new machines, whose production shall attain a maximum with a minimum expenditure of labor.

As for the cost of manufacturing, it might be supposed that the preparation of carbonic acid by heating bicarbonate of soda was more costly than by the treatment of chalk by sulphuric acid; but the contrary is the case. In the Beins system, there is obtained, as a secondary product, anhydrous carbonate of soda, which is almost absolutely pure, and which in commerce is called calcined soda. This salt has a great value, and is sold to bleaching works. Manufacturers of carbonate willingly buy it back, in order to saturate it anew with carbonic acid. So the soda may be considered as serving as a material for the carriage of carbonic acid in the solid state. In former systems the secondary products are troublesome and useless. The cost price of a hectoliter of carbonic acid prepared from the bicarbonate reaches 20 centimes only; and the apparatus, with its furnace, retorts, etc., costs 1,600 francs.—*La Nature.*

How Celluloid Billiard Balls are Manufactured.

The manufacture of billiard balls from celluloid and bonsilate is a peculiar industry, and confined to the city of Albany, N. Y., the only factory in the world, according to the *Argus*, being located at our State capital. A large proportion of the balls now made are of celluloid, but only for the reason that the machinery is not as well adapted to the manufacture of bonsilate balls. The time will come, however, when all balls will be made of the latter material. The celluloid, which is received in large white sheets, is first cut into small square pieces about five-eighths of an inch in size. These are placed into moulds, previously heated by steam to the proper temperature.

They are then placed in the hydraulic presses, and with a pressure of from 1,500 to 2,000 pounds to the square inch are roughly moulded, heat at the same time being applied. The various positions of the blocks in the mould give the ball the peculiar mottled appearance when finished. Experiments have been made by grinding the celluloid to a powder, and using it in that form, but nothing has succeeded so well as the present method. After being taken from the moulds, the balls are turned absolutely spherical by an exceedingly ingenious device The processes in the manufacture of bonsilate balls are quite different in many respects.

The material is placed in the moulds in powder, and the balls, after being roughly pressed up, considerably larger than the required size, are covered with rubber and tin foil, to prevent the material from being injured by water, and are then placed under water pressure. By means of this, which is the only machine of the kind in existence, the balls are placed under a pressure of from 3,000 to 4,000 pounds to the square inch. The water touching the ball at every point, and the pressure being equally transmitted, the result is a perfectly pressed sphere, of just the same specific gravity in one spot as in another. Without this apparatus, the successful manufacture of billiard balls from bonsilate would have been impossible. A simple but ingenious contrivance is also employed to ascertain when the balls are perfectly poised or balanced. They are first weighed and are then placed in a flat dish of mercury. This subtle fluid detects the slightest shade of inaccuracy, and the balls are put in the lathe and corrected until they are absolutely true. Not only billiard, but pool and bagatelle balls are made.

The prices at which they are sold are far below those charged for ivory, ranging from $5.50 to $13.50 per set of four balls for billiards, and from $26 to $50 per set of sixteen balls for pool.

Enameling Photo Prints Without Collodion or Gelatine.

BY R. OFFORD.

At a recent meeting of the London and Provincial Photographic Association some prints enameled in a novel manner having been passed round for inspection, and a discussion having arisen thereon, perhaps it would be better to define clearly the process by which those rough specimens were produced.

The method of my procedure is as follows:

Prepare a piece of perfectly smooth flat glass free from scratches, a little larger than prints to be glazed. Thoroughly polish with any well known preparation (such as methylated spirit, nitric acid, and tripoli). Be careful not to leave the least smeariness from the last cloth, which should be perfectly dry. Make a rubber of flannel by wrapping up half an ounce of French chalk (talc) in powder in two folds of new flannel, and tying around with string, like a rough printer's dabber. Keep this always in a box free from dirt and chemicals. Strike the polished glass lightly with this all over, until the chalk is seen covering the surface, then rub it all over firmly with the dabber, until the chalk has apparently all gone but at the edges. Take trimmed prints straight from the last washing bath, or if they have been allowed to dry, soak them in clean water for an hour or two. Having immersed the polished and talcked plate in a dish of water, face up, quickly transfer prints to the dish, and press them lightly, face downward, upon the glass. Take care not to rub the surface of the glass, or allow prints to slide about much over it.

Quickly remove to a squeegee board, such as is used in carbon printing, with a piece of rubber cloth nailed to one end. Lightly squeegee prints under cloth several times, from center to each end. Raise cloth, carefully wipe the back of glass, and examine for air bubbles. If there are none, blot off superfluous water from face, and allow to dry slowly. If there are air bubbles, replace glass in dish of water, allow prints to float off, gently replace, and repeat the process. They are better if not dried too quickly. In an ordinary room, not warmed, they will dry in from one hour to two, and will then drop off. The question of how to mount prints thus treated, and yet retain the delicate gloss which gives even greater transparency to the shadows than the ordinary enameling, is not easy to answer.

It has been suggested to employ Mr. Cowan's method of starching, either before putting on the glass, or as soon as the superfluous water has been removed. In the first case, the print cannot be soaked enough to make it adhere closely to glass without air bells, or the squeegeeing removes the starch. In either case, the print is not certain to leave the glass when dry, unless the glass is treated with alcoholic solution of soap, and this at the expense of the delicate gloss. Afterward, when placed on a wet card, considerable pressure is required in a rolling press to make surfaces adhere; this again destroys the gloss. The most successful plan hitherto adopted, is to coat back of print with India-rubber solution, and the face of mount with the same. The solution must be free from dust and dirt, and must be evenly laid on. When dry, the print and mount can be carefully pressed together, and subjected to very light rolling in a press. The best result is produced by a polished steel plate and single roller above, with print laid down on plate, and a piece of stout card intervening between roller and back of mount. Pressure only just enough to bring surfaces fairly together should be used.

The Hektograph Anticipated.

The gelatine pad now so extensively used for reproducing copies of letters, and for which a United States patent was granted, now appears to be only a revival of the old French method of transferring letters and designs to the surfaces of crockery in the ornamentation of the same. The *Glassware Reporter* says:

"An old French method of printing and transferring was to cast a sheet of glue, a quarter of an inch thick, diluted, while warm, to such a consistence that when cool it was perfectly flexible and pliable as leather. The impression was first taken from the copper plate upon this sheet of glue, and then transferred to the article requiring decorating. The glue could be applied to the ware two or three times before it became necessary to take a fresh impression from the plate. Black printing, in the Staffordshire potteries, was at one time done by a similar process; the gelatine bats being cast on dish bottoms, and then cut to the size required for the patterns. But this printing from bats has now fallen into disuse."

REVOLVING SCALE CARS.

The revolving scales car shown in the accompanying figures was devised by Mr. H. Garin, for the purpose of simplifying the handling and weighing of articles in shops, factories, stores, etc. It permits, in fact, of the carriage of articles whose weight has just been registered, without its being necessary to load and unload them anew.

On examining the figures, it will be seen that the apparatus as a whole consists of: (1) a car mounted upon four flanged wheels; and (2) a platform revolving upon the frame of the car through the intermedium of six rollers, and carrying a scales provided with three sliding weights. As the height of the platform above the rails is only 0·8 m., the unloading and loading may be performed with facility, and, besides, owing to the revolving arrangement, articles of large dimensions may be carried in such a direction as to prevent them from interfering with surrounding objects.

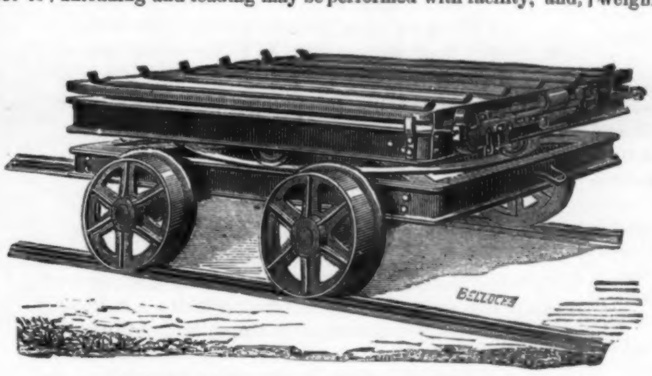


Fig. 4.—GARIN'S REVOLVING SCALE CAR.

The car, properly so called, presents no peculiar details of construction, it being formed of I-irons connected in pairs and carrying journal boxes for the axles to revolve in.

The crosspieces are provided in the center with a trace hook, and to one of them is attached a sliding bolt, which, on being slipped into a corresponding socket in the movable platform, holds the latter fast in any position that may be desired.

In the center the car also carries, through the intermedium of irons bolted to its frame, a cast iron bush which receives the pivot around which the turn table moves (Figs. 1 and 2). The rollers, which revolve over an iron circle affixed to the car frame, are held by supports, R, affixed to the I-irons, C. As the position of these rollers does not correspond to an exact division of the circle, the axles, *a*, have an irregular direction and are bent vertically, so that they may be bolted by their extremities to a disk that is traversed by the pivot, *o*.

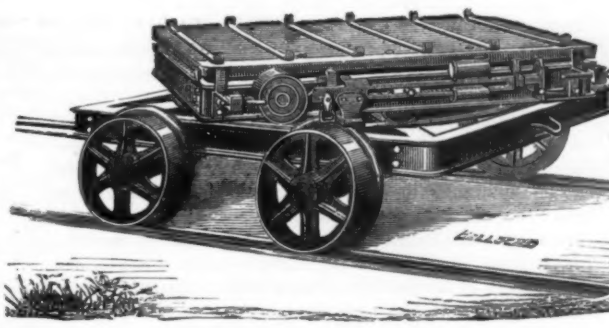


Fig. 3.—REVOLVING SCALE CAR.

Finally, above the frame, C, is the turn table, P, these two parts being connected by the mechanism of the scales.

The loading platform or turn table, P, is connected by four angle irons, S, with four levers, L, joined together in pairs by means of the crosspieces, B.

These two systems, one to the right and the other to the left, are then united in one common support, H. The levers of the second system, which are rendered mutually interdependent by a piece, J, press by their knife edges upon the lateral branches of the support, H, while those of the first are bolted side by side and run to its center, where they rest upon a conical fulcrum. One of these latter levers, L, receives the stress that corresponds to the entire load, and transmits it, through its prolongation, *l*, to the short arm of the scale beam, I.

The points of suspension of the table, P, on the levers, L, are provided with knife edges that rest on steel bearings. The same is the case between the angle irons fixed to the frame, C, and the crosspieces, B, where the levers inclosed have their extremities bent, so that the knife edges shall all be on the same horizontal line.

The beam of the scales is pivoted upon a support, *s*, formed of an angle iron and two vertical plates that are provided with bearings in contact with a double knife edge set into the beam. Its free extremity carries an index, which oscillates in front of another index, fixed to the frame, E, when a catch-tappet no longer sustains the beam. The suspension of the extremity, *e*, of the point of application of the load is effected by means of two links coupled together and provided with knife edge bearings.

The two perspective views show very clearly the arrangement of the principal parts of the mechanism that serves for weighing. The principal sliding weight consists of two hollow copper cylinders, connected with each other, and sliding on the edge of the beam, I. The division to which this weight corresponds is graduated from 200 to 200 kilogrammes, and is marked by grooved lines. The second weight indicates kilogrammes, and slides in a longitudinal slit in the beam. The third weight, which indicates hectogrammes, is placed upon a small bar whose support is screwed to the beam. Lastly, the shorter arm of the beam is prolonged by a rod on which is mounted a counterpoise that balances the mechanism and permits of regulating the scales accurately. The scales thus constructed are capable of weighing with accuracy heavy loads without the use of any movable weights.—*Revue Industrielle.*

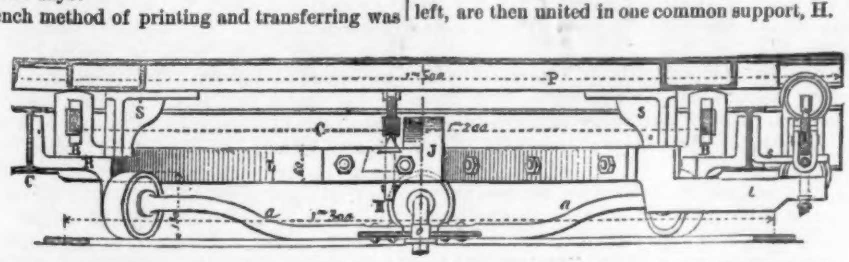


Fig. 1.—HALF LONGITUDINAL SECTION, AND HALF SECTION PASSING THROUGH THE POINT OF APPLICATION OF THE LOAD.

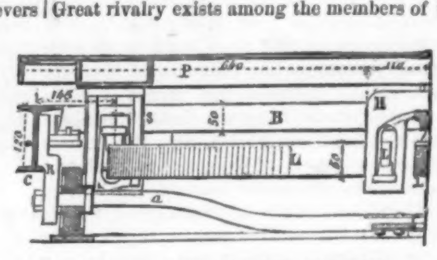


Fig. 2.—HALF TRANSVERSE SECTION.

Lightning Conductors.

Something recently stirred up the good people in Edinburgh to inquire into the condition of the lightning conductor supposed to keep guard over the spire of the General Assembly Hall in that city. Accordingly a "steeplejack" was called in and sent to the top of the said spire, some 240 feet above *terra firma*, with instructions to attach a copper wire to the upper end, and thus enable the conductor to be tested. The latter appears to have been put up some 28 or 29 years ago, and to have consisted of a ¾ inch copper rod, connected by screwed joints. Upon testing the conductor by sending a current through it *via* the copper wire, its resistance was found to be as much as 800 ohms, at least, so our contemporary, the *Scotsman*, states. This was, of course, sufficient to condemn the rod at once, and accordingly arrangements were at once made to fix a new copper wire rope conductor, ⅝ of an inch in diameter, which, after reaching the ground, was carefully soldered to a water main. When this was completed, the resistance of the metallic circuit, consisting of the test wire and the new lightning conductor, was discovered to be somewhat less than $\frac{8}{10}$ of an ohm; and when the earth connection was included in the circuit, the resistance did not exceed one ohm. It may, therefore, be assumed that the spire is now, for the first time, thoroughly protected against lightning, while the condition of the new conductor can be learned at any time without undertaking the serious task of ascending to the top of the spire.

The work has been satisfactorily executed by Messrs. Ritchie & Son, Leith Street, Edinburgh, under the direction of Mr. Robertson, of Her Majesty's Office of Works. We have frequently alluded to the urgent necessity for periodical tests being made of the conductivity of lightning rods. There are many conductors in no better condition than that mentioned above, and which, instead of being a safeguard, are positively dangerous.—*The Electrician.*

A Citizens' Fire Brigade.

At Wakefield, Mass., a fire brigade has been formed among the citizens for the mutual protection of property, the inspiring principle of the association being that five minutes' work at the commencement of a fire is better than an hour's work after the conflagration is in progress. Each member of the brigade is provided with a small hand pump, and proceeds to the fire on the first sounding of the alarm. Great rivalry exists among the members of the company to arrive first at the scene of action, and to stimulate this praiseworthy emulation, a prize is awarded to him who succeeds in playing "first water" on the flame.

The association has already done some very good service, and quite a number of fires have been put out before either of the two hand engines of the town have arrived at the scene. If more of our country villages could boast of such protective associations, we should see fewer accounts in the papers of houses and barns destroyed, and the reduction in the insurance rates would very soon pay the cost of all the apparatus and the expenses attending the organization.

Nitro-glycerine.

Unfortunately nitro-glycerine enjoys just now an unenviable notoriety. The word is in all mouths, and nitroglycerine is discussed in every circle. In another place we have said something concerning the effects which it can produce, and the proper method of destroying it. We propose here to explain what nitro-glycerine is, in such a way that our non-chemical readers may understand what this thing is to which appertain such deadly attributes.

Nitro-glycerine is produced by mixing nitric and sulphuric acids with glycerine at a low temperature. The important agents are the glycerine and the nitric acid. The sulphuric acid appears to do little save attract to itself any water which may be present in the glycerine or the nitric acid. It is well known that sulphuric acid has a strong affinity for water, and it is this characteristic which renders it useful in this connection.

Nitric acid is prepared by treating nitrate of potash—saltpeter—or nitrate of soda, with sulphuric acid—oil of vitriol. The saltpeter is placed in a kind of still, the sulphuric acid is added; the retort or still is heated cautiously, and the nitric acid rises in the form of vapor, which is condensed and collected for use. It can be purified and concentrated by redistillation with a quantity of sulphuric acid. Nitric acid is one of the most corrosive acids known. In chemical notation its formula is HNO_3. That is to say, it is composed of one atom each of hydrogen and nitrogen and three atoms of oxygen. It is known as hydric nitrate and as aquafortis. Its composition was first investigated by Cavendish in 1785, but it seems to have been known to the old alchemists. It possesses the property of producing explosive compounds with great freedom, its energy being due principally to the nitrogen which it contains; and it is worth notice that, as has been pointed out by Kempshead, although apparently possessing nothing but negative qualities, it in combination forms part of the most powerful and active substances known, as, for example, nitric acid and ammonia, the extremes of acidity and alkalinity. It is a constituent, too, of strychnine, morphia, and prussic acid, and is a component of all valuable foods.

With the characteristics of glycerine all our readers are, no doubt, familiar. It is found on most toilet tables, and in every family medicine chest; it is used as a lubricant, and a mixture of glycerine and water is employed for charging the dash pots or cataracts of certain arc lamps. It is a slightly sweet, smooth, clear, sirupy liquid, almost tasteless, and nearly devoid of odor. It will, no doubt, surprise many of our readers to learn that it is an alcohol. It can be obtained from all solid animal and vegetable fats, and from most oils. It is freely produced when an oil is treated with an alkali—saponified—in presence of water. It is made in stearine candle factories, and can also be obtained from old soap lye. It is best produced pure by beating up an oil or fat with about half its weight of water into an emulsion. This is then pumped through a coil of iron piping heated to the temperature of melting lead, the rate of pumping being such that the mixture of oil and water will occupy about ten minutes in traversing the coil. The fluid which comes out from the worm quickly separates into two portions, glycerine lying at the bottom. The supernatant oily liquid being drawn off, the glycerine remains, nearly pure. Its formula is $C_3H_8O_3$.

Nitro-glycerine is made by adding nitric and sulphuric acids to glycerine. Unfortunately, no skill whatever is required to produce the required explosive, only a knowledge of one or two simple facts; but skill is required to produce nitro-glycerine pure enough to be comparatively safe. For obvious reasons we must decline to say how it can be rendered pure; and lest our younger and less cautious readers should undertake the manufacture for themselves of a few drops or other small quantity, for the sake of experiment, we decline to give the proportions of acid and glycerine which must be used; and we may add that it is quite possible to make a non-explosive mixture apparently nitroglycerine, and that, lacking a knowledge of the details of manipulation, the man who wants to make it will be pretty certain to fail—on the whole, a very fortunate circumstance.

Nitro-glycerine is a brownish, smooth, oily liquid, and a deadly poison. It formula is $C_3H_5N_3O_9$. Its explosive force is due to the unstable nature of the compound. We have in most explosives carbon, hydrogen, and oxygen to begin with; to these have been added—by treatment with nitric acid—a certain portion of nitric peroxide, NO_2, that is, one atom of nitrogen and two atoms of oxygen; but these two gases have a very feeble affinity for each other, while, on the contrary, the carbon and the hydrogen have intense affinities for oxygen. On the least provocation, therefore, the oxygen leaves the nitrogen, which, set free, ceases to be a liquid, and becomes a gas, while intense heat is produced, which volatilizes and breaks up the other compounds, and augments enormously the pressure of the escaping gases. Those who are familiar with the experiments of Pictet, on the liquefaction of gas, know how intense is the cold and how enormous the pressure required to liquefy even a small quantity of such a gas as nitrogen, but this liquefaction has been accomplished in the explosive by chemical affinity; and the moment this affinity is destroyed, the chained force is let loose—we know with what result. Now, it will be seen that nitro-glycerine ought to be a powerful explosive, for in it no less than three molecules of NO_2 take the place of three atoms of hydrogen, as will be seen at a glance if we reproduce the two formulæ here. Glycerine is $C_3H_8O_3$; nitroglycerine is $C_3H_5N_3O_9$; the carbon remains unaltered; and three atoms of hydrogen have disappeared. In their stead we find three atoms of nitrogen, and oxygen rises from 3 to 9. Nor does nitro glycerine fail to satisfy the expectations that we might form concerning it. It is the most powerful explosive known. As will be gathered from the following figures, there are two classes of explosion—the first is known as detonation, the second as explosion:

	Second-class. Exploded.	First-class. Detonated.
Gunpowder	1	4·34
Guncotton	3	6·46
Nitro-glycerine	4·8	10·13

Here we see that, taking gunpowder fired in the ordinary way as 1, it will detonate with four and one-third times more force, and detonated nitro-glycerine is 10·13 times more energetic than fired gunpowder. As to the actual dynamic power or potential energy possessed by one pound of each of five well known explosives, the following table gives the facts:

	Foot tons per lb.
Gunpowder	480
Guncotton	716
Nitro-glycerine	1,139
Picrate of potash	536
Chloride of nitrogen	216

Chlorine possesses some of the properties of nitrogen as regards the production of explosives, which are, however, so unstable that they are unknown out of the laboratory, as, for example, chloric peroxide, ClO_2. It is obtained by acting on fused chlorate of potash with about two-thirds of its weight of sulphuric acid. It is at ordinary temperatures a gas, but a slight increase of pressure or a freezing mixture condenses it into a fearfully explosive red liquid. Chlorous anhydride is a yet more dangerous compound. Chloride of nitrogen is produced by passing chlorine through a solution of ammonia. Not more than a few drops at a time have been experimented with, for it detonates if blown on or touched with a feather. It is believed that the celebrated scheme of Lord Dundonald for destroying Sebastopol from a balloon during the Crimean War was based on the notion that it would be possible to produce a couple of gallons of chloride of nitrogen, send it up in a balloon, and drop it in the heart of Sabastopol, when it would explode with the shock and wreck everything. Apart from the impossibility of doing anything of the kind, we may say that the chloride of nitrogen would have proved very ineffective. It would not do half as much general mischief as the same weight of gunpowder, but its local action would have been very intense. Thus, a drop of it exploded on a table will suffice to shatter the leaf of the table, but the actual work which it would perform in raising a weight or propelling a shot from a gun would be insignificant.

All that concerns the exact mode of operation of explosives is still involved to a certain extent in doubt. It is impossible to do more than collect the products of combustion and assume from them that certain chemical changes have taken place, but there is no satisfactory evidence that we can follow the whole chain of events. It is only known that the mechanical action of all explosives depends on the sudden conversion of an element from a solid or liquid state into that of a gas with an enormous augmentation of bulk. It is worth notice, moreover, that every explosion is accompanied by two distinct effects, first, the violent repulsion of the air from a given space, which may be regarded as the primary effect; the highly heated gas quickly cools, a partial vacuum is formed, and the air rushes in from all sides to fill it. This produces the secondary effect, which may be confounded with the first. An admirable example of the secondary effect was supplied at the Whitehall Club, when the explosion took place at the Government Offices, the plate glass windows being blown outward into the street, not inward into the house.—*The Engineer.*

Hardening and Tempering Steel.

One of a series of lectures to the Liverymen and Apprentices of the Company of Cutlers of London was lately delivered by Professor W. Chandler Roberts, F.R.S., "On Some Theoretical Considerations connected with Hardening and Tempering Steel."

The Master of the Company, Mr. J. Thorne, presided, and the lecturer observed that the phenomena with which they had to deal, although admittedly as interesting and remarkable as any in the whole range of metallurgy, are but little understood.

If the fact that steel can be hardened had not been known, the whole course of our industrial and even political history would probably have been widely different, and the dagger, which occupies so prominent a place in the armorial bearings of the City of London, would have represented a survival of implements made, not of steel, but of copper hardened with tin.

It has long been known that there are extraordinary differences between the properties of wrought iron, steel, and cast iron, but our knowledge that these differences depend upon the presence or absence of carbon is only a century old, for it was not until the year 1781 that Bergman, professor in the University of Upsala, showed that wrought iron, steel, and cast iron when dissolved in certain acids, leave amounts of a graphitic residue, varying from one-tenth to 2½ per cent, which are essential to the constitution of these three varieties of metal. Bergman's work led many early experimenters, notably Clouet in 1796, to attempt to establish the importance of the part played by carbon, and Clouet converted pure iron into steel by contact at a high temperature with the diamond, which was the purest form of carbon he could command. Prof. Roberts said that this experiment had been repeated by many other observers with varying success, as in all the earlier work the furnace gases, which had not been excluded, might have converted the iron into steel without the intervention of the diamond. It remained for a distinguished master of the Cutlers' Company, Mr. W. H. Pepys, to repeat Clouet's fundamental experiment under conditions which rendered the results unequivocal, by employing electricity as a source of heat. This experiment, which had been communicated to the Royal Society in 1815, was performed in the way Pepys had indicated.

It was then shown that in soft, tempered, and hardened steel respectively the carbon has a distinct "mode of existence," as is indicated by the widely different action of solvents on the metal in these three states.

The evidence as to whether carbon in steel is *combined* in the chemical sense, or is merely *dissolved*, was then considered at some length, special reference being made to the results obtained by various experimenters, from Berzelius and Karsten to Sir Frederick Abel of the War Department.

Prof. Roberts stated that the researches of Troost and Hautefeuille afforded strong evidence that in "white cast iron" and steel the carbon is merely dissolved, a view which he adopted, as he did not consider it to be at all in opposition to the facts recently established by Sir Frederick Abel, who had shown that the carbon may be left by the slow action of solvents on soft steel as a carbide of iron.

The various physical, as distinguished from the chemical, theories that had been propounded from the time of Reaumur (1722) to that of Akerman (1879), to account for the "intimacy of the relation" of carbon and iron in hard as compared with soft steel, were then described at some length, and the remarkable experiments of Reaumur, who cooled steel slowly in a Torricellian vacuum in order to show that the bsorption of gas did not take place during cooling, were illustrated.

In recent years much importance has been attached to the physical evidence as to the peculiar constitution of steel, and it has been shown that there is a remarkable relation between the amount of carbon contained in different varieties of steel and their electrical resistance. Some of the very interesting experiments of Professor Hughes on this point were then exhibited and described, and Professor Roberts concluded by saying that the value of the early work by Bergman and Reaumur had rather been lost sight of in recent discussions, Bergman's work being specially remarkable, as he attempted, by thermometric measurement, to determine the heat equivalent of the phlogiston he believed iron and steel to contain.

The importance of the degree of carburization of steel from the point of view of its technical application was illustrated by reference to a series of curves, and it was incidentally mentioned that, in the case of the variety of steel used for the manufacture of coinage dies, the presence of one-tenth per cent of carbon more or less than a certain standard quantity makes all the difference in the quality of the metal.

Celluloid.

The *Journal of the British Dental Association* quotes from *Le Progres Dentaire* a description of the process carried out at a factory near Paris for the production of celluloid.

A roll of paper is slowly unwound, and is at the same time saturated with a mixture of five parts of sulphuric acid and 2 of nitric, which falls upon the paper in a fine spray. This changes the cellulose of the paper into pyroxyline (gun cotton). The excess of acid having been expelled by pressure, the paper is washed with plenty of water until all traces of acid have been removed; it is then reduced to pulp, and passes on to the bleaching trough. Most of the water having been got rid of by means of a strainer, the pulp is mixed with from 20 to 40 per cent of its weight of camphor, and the mixture thoroughly triturated under millstones. The necessary coloring matter having been added in the form of powder, a second mixing and grinding follows. The finely divided pulp is then spread out in thin layers on slabs, and from twenty to twenty-five of these layers are placed in a hydraulic press, separated from one another by sheets of thick blotting paper, and are subjected to a pressure of 150 atmospheres until all traces of moisture have been got rid of. The plates thus obtained are broken up and soaked for twenty-four hours in alcohol. The matter is then passed between rollers heated to between 140° and 150° Fah., whence it issues in the form of elastic sheets. Celluloid is made to imitate amber, tortoiseshell, coral, malachite, ebony, ivory, etc., and besides its employment in dentistry is used to make mouthpieces for pipes and cigar holders, handles for table knives and umbrellas, combs, shirt fronts and collars, and a number of fancy articles.

Recent Progress in the Ozokerite Industry in the East.

BY E. SAUERLANDT.

Ozokerite or mineral wax frequently accompanies petroleum, and traces of it are found in many places in Eastern and Western Galicia, and in the Caucasian and American petroleum territory, but it is rarely found in such quantities as to furnish a source of this valuable mineral. It is highly probable that many more workable deposits of ozokerite will be discovered yet, but hitherto the discovery of deposits that yield paying quantities have been so rare that we are greatly pleased to be able to announce that the past year did not pass without some success in this direction.

At the baths of Truskawiec, some five miles from Boryslaw, a deposit of this substance was found at a slight depth, of such extent that fifty tons have already been taken out and sold. The wax contains sulphur, and hence the oils produced in making paraffine from it must be used with some special precautions. This discovery of ozokerite in Truskawiec is the more interesting because Leo Strippelmann several years ago, in his well known work on the petroleum industry of Galicia, had referred to this place as particularly worthy of examination for the occurrence of ozokerite.

The same mineral is also reported as occurring in the neighborhood of Agram in Croatia, and investigations made there have proved the existence of deposits of considerable extent and tolerable thickness. Whether the hopes based thereon will be actually realized, the future must decide. At all events, this notice and the announcements of recent discoveries of ozokerite in Russia, must be received with caution, for such announcements have frequently been made and no important results followed.

Other places in Eastern Galicia which may be looked upon as sources of ozokerite, besides Truskawiec, are Boryslaw, Dwiniacz, and Starunia, with Boryslaw at the head as hitherto. In all three of these places the wax is found in Miocene clay shales and clay marls with the intermediate sandstone, and frequently it accompanies rock salt and gypsum. While shafts have been sunk in Boryslaw to the depth of 200 meters (nearly 700 feet), they have not penetrated deeper than 30 or 40 meters (100 or 130 feet) in Starunia and Dwiniacz.

In Boryslaw the majority of the shafts are at present in the possession of three large companies, the oldest of which, "The French Mineral Wax and Petroleum Society," has been in existence for years, while the "Lemberger Credit Bank" and the firm of Gortenberg, Liebermann & Co., have commenced operations within the past year by the purchase of numerous shafts. In the first half of last year the first named society could point to a large production, but almost completely exhausted their present horizon and are now going deeper, but with a smaller yield. The two other societies had, and still have, to contend with the drainage of their long neglected shafts, and hence their production is not as large as could be desired.

In Boryslaw-Wolanka the production of mineral wax for the year 1882 was less than the preceding year, but in view of the difficulties to be overcome, it must be considered relatively speaking as favorable, and cannot be much less than that of 1877, which was 8,300 tons.

The price fluctuated from January, 1882, when it was 27¼ Austrian florins (about $14) per 100 kilos, to 25 florins in May, then steadily rose until the highest point (31½ florins) was reached in November, and there it remains. It is very questionable if the manufacturers can use it profitably at this price, and several establishments have already imported American paraffine to take its place, and with good results. As it may be expected that the production of ozokerite will increase in the immediate future, we may predict a fall in the price.

Dwiniacz and Starunia yield about 25 tons per month, which at present prices pays well.

Before passing to the method of working it up, we must first consider how it is obtained, as one of the methods yields a product already partially purified. We refer to the extraction of the wax from the gangue called "lep." By melting it under water the greater part of the ozokerite is removed, but the residue still contains as much as 12 per cent of wax. These residues collect in enormous quantities, and hitherto were only considered as a nuisance, although the wax still in them represented an enormous capital. It is surprising that this capital was allowed to lie idle so long. It cannot be due to the small quantity of wax in it, because at the Brown coal works in Halle it pays to work coal which only yields 10 per cent of tar, or 12 to 15 per cent of tarry resins. The cause may be sought chiefly in the difficulty of working the residues, since the high price of fuel prevents its being liquated or distilled on the spot, and there is no suitable apparatus for extracting so dense a substance as clay and shale. According to the *Neue Freie Presse*, an ozokerite mechanic made an apparatus in 1879 that would make 6,600 to 7,700 pounds of pure wax from ten times that quantity of ore daily, yet this apparatus of the unnamed workman has never been in operation.

In the past year J. Merz in Boryslaw-Wolanka, first succeeded in working these residues in his extraction apparatus, which has been patented in most countries. If the extractors now in use have not been constructed on so large a scale and capable of so large a daily yield as the one made in 1879, they have the undeniable advantage that they work, not merely on paper, but in reality.

About one-third of the ozokerite that comes into the market is worked into paraffine, and two-thirds into ceresine. The use of mineral wax for making paraffine has increased, especially in Galicia, and here, too, distillation in superheated steam is commonly employed.

A large portion of the paraffine made is consumed there for making the Sabbath candles used in their religious rites by the Jewish inhabitants. It is not so carefully purified for this purpose as is done elsewhere.

The Galician factories for the most part refine the largest possible quantity (50 to 70 per cent) of the waxy distillate directly with fuming sulphuric acid and without pressing it. Of course the resulting paraffine is not free from oil, but is tolerably white in color and useful for the purpose mentioned.

Very little has been made public concerning improvements in making paraffine from ozokerite, and manufacturers keep their experience as secret as possible.

In 1881 E. Van Haecht and J. Schreier obtained a patent for purifying paraffine by blowing out the contaminating oils with superheated steam. It can be used for paraffines containing as an impurity light oils, as is the case in careful distillation, with the first portion of the wax distillate, and so long as the paraffine already present in the wax goes over undecomposed. The crude paraffines resulting from the decomposition of resinous bodies, as for example in the dry distillation of brown coal, or of the resin obtained by distilling ozokerite, cannot be purified by this method, as they contain oils specifically heavier than and often having as high a boiling point as the paraffine itself.

In 1881, H. Ujhely took a patent for refining and hardening paraffine. According to the English specification, the crude paraffine was melted with a mixture of petroleum benzine, and alcohol (methylic, ethylic, or amylic), and after cooling slowly it is expressed. The advantages gained in this way over the common use of benzine (photogen) alone, in our opinion, consists merely in obtaining an oil more free from paraffine, since paraffine is considerably less soluble in alcohol than in benzine. Whether this is sufficient to counterbalance the disadvantages of working with alcohol, we will not attempt to say. We know, however, that in 1873 a paraffine factory added fusel oil to the paraffine for pressing, but after a few months returned to the use of benzine.

The yield of paraffine is essentially increased when superheated steam is employed in the distillation of the ozokerite, and in working a wax suitable for making paraffine it amounts to 60 or 70 per cent. Hence we can no longer adhere to the data hitherto published, which place the limits at 36 to 50 per cent.

In making ceresine the chief improvements consist in a profitable utilization of the residues. Two methods are chiefly employed in the factories themselves. The first and simpler consists in heating the ozokerite with fuming and common oil of vitriol to 200° C. (392° Fah.) until the greater part of the acid is removed either by decomposition or evaporation, and then treating it at a suitable temperature with neutralizing and decolorizing agents such as alumina, silicates, bone coal, the refuse of prussiate factories, etc. By the second method the resinous and discoloring constituents of the wax are also removed with acid, but at a relatively low temperature, thus avoiding so thorough a decomposition.

To bleach ozokerite perfectly on a large scale without the use of acids has as yet remained an unfulfilled desire, although in 1879 a method for accomplishing it was announced as a new discovery of H. Ujhely in Vienna. Without going into a discussion of priority, we must remark that George Gwynne in his English patent of 1871 for "treating fatty and hydrocarbon bodies," etc., describes a process for bleaching ozokerite which possesses a striking resemblance to that of Ujhely. Gwynne removes the mechanical impurities and then dissolves it in benzine, filters through bone black, and removes the solvent by blowing in air. This method is identical in principle with Ujhely's. Gwynne did not obtain any practical results, nor has Ujhely, nor Ofenheim, who took a patent on the same thing in 1879. The statements made then, that a factory was being built with a large apparatus on Ujhely's system, was based on facts; but it must be added that the building stopped before it was finished, and that the unfinished building has been in that state for two years, while the large apparatus remains in the workshop awaiting payment by the man who ordered it.

Even if the difficulties that beset the working of Ujhely's patent on a large scale were overcome, and the consumption of decoloring agents reduced to a minimum, the product obtained would find only a very limited field of sale. Ujhely's "bleached mineral wax" would not be in much demand as an independent illuminant, owing to the large quantity of oxygenated resin in it, most of which is removed by the present method of treating it with sulphuric acid.

Finally, we may be permitted one short remark about a circumstance which has hitherto received too little attention.

Ceresine and paraffine are largely employed, as every one knows, for adulterating beeswax, and the methods in use for the detection of such adulterations are frequently based upon a determination of the specific gravity of the specimen in question. A short time ago a table was published (*Chemiker Zeitung*, vi., page 74) giving the specific gravity of different kinds of wax and their mixtures, but in our opinion it is of very little use because it sets out with false premises in assigning a definite specific gravity to paraffine and ceresine. The specific gravity varies from 0·869 for that which melts at 100° Fah. to 0·943 for that melting at 180° Fah., as was shown by the author as early as 1878.

The following table shows the melting points of ozokerite paraffine:

Solidifying points.		Spec. gravity.
56° C.	133° Fah.	0·912
61° C.	142° "	0·922
67° C.	153° "	0·927
72° C.	162° "	0·935
76° C.	169° "	0·939
82° C.	180° "	0·943

Since the specific gravity of paraffines that solidify at different temperatures is different, ozokerite and the ceresine made from it must differ in specific gravity. Then we must consider that commercial ceresine frequently receives an addition of paraffine, resin, carnauba wax, etc., by the manufacturers themselves.—*Chemiker Zeitung.*

Microscopic Examination of Printed Cotton Goods.

BY RICHARD MEYER.

"Fast colors" on fabrics are, as everybody knows, produced when a solution of the dye, or the materials from which it is formed, penetrate the fiber in a soluble state and are then rendered insoluble *within* the fiber. The substance of the fiber itself may take an active part in the formation of the precipitate, or the fiber may serve merely as the vessel in which precipitation takes place, allowing the solution to enter freely, but encircling the precipitate formed therein, and to a certain extent holding it prisoner.

This may take place during the operation of dyeing, or, what is very common in calico printing, may be accomplished by printing first and then steaming. In recent times these "steam colors" have been gradually gaining ground, artificial alizarine having contributed not a little thereto. But among these there is a different class, the fixing of which depends on a totally different principle; these are called the "albumen colors." These serve the purpose of rendering colors useful which, owing to their insolubility, or their utter indifference to cotton fibers, could not otherwise be employed for calico printing. These dyes are first mixed with a solution of albumen, then printed upon the goods, and afterward steamed. This coagulates the albumen, which sticks the dye fast to the fiber. The union is a very intimate one, and if the dye itself is permanent, perfectly fast colors can be obtained in this manner. This method is particularly useful for aniline dyes and certain mineral colors like ultramarine, Guignet's green, etc.

In the examination of printed cottons to ascertain what dyes have been used and how they were made, the question frequently arises as to whether the dye was formed within the fiber or was used already made and fixed with albumen. Both methods can be employed under different circumstances with one and the same dye. For example, it is a very common method of procedure to impregnate the fiber with a soluble salt of lead, to precipitate this as hydrate, carbonate, or sulphate, and then convert this into a fiery orange red basic chromate of lead. In combination with steam colors, however, it is far more convenient to print the "chrome-orange" with albumen and then fix it by steaming. How can we tell which of the two methods has been employed?

The first thought would be to test for the presence or absence of albumen. The affinity that albumen has for organic dyestuffs, and which is wanting in cotton fibers, might offer a means of doing so. But when goods dyed with chromate of lead are put in a solution of such a dye, it is found that, whether albumen is present or absent, more or less of the dye is fixed to the spot where the lead is, causing a dirty color, so that no sharp distinction can be made in this way.

A glance through the microscope offers a rare surprise. By macerating some of the tissue with a needle so that we can see the individual fibers of cotton, they will be seen to be uniformly dyed throughout the whole mass and transparent. In many dyes little granules are seen, but the characteristic form of the fibers is unaltered and distinctly recognizable, with the dyestuff deposited uniformly everywhere *within* it.

With the albumen process it is quite different. The fibers are seen to be totally uncolored. In numerous places there are little single colored shreds of coagulated albumen, adhering to the *outside*. Little isolated groups of shreds can also be seen here and there in the field of view, having been separated from the fiber by maceration.

When chromate of lead has been fixed with albumen, the flakes of albumen and pigment will appear opaque and almost black in transmitted light, but distinctly red by reflected light. Ultramarine attached with albumen forms beautiful transparent light blue flakes, but otherwise has the same character as the chromate.—*Berl. Berichte*, 1883.

Separating Citric and Tartaric Acids.

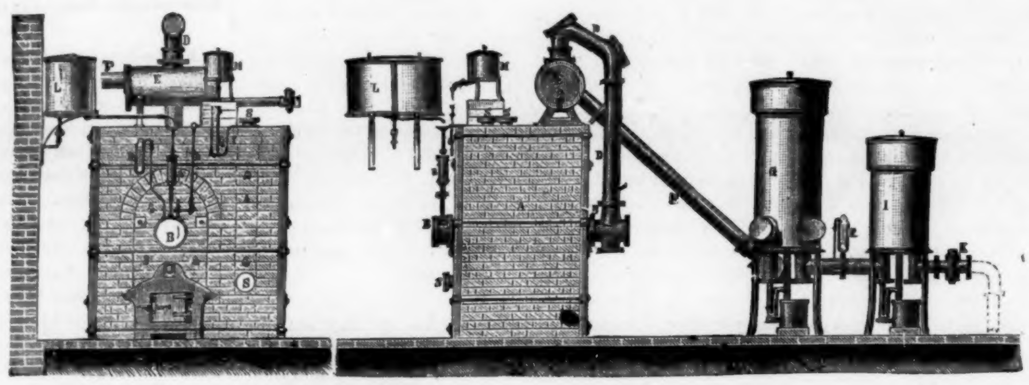
C. Rovera contributes the following to the *Giornal Farm. Chim.* A solution which contains both acids is neutralized with sodium carbonate, and then boiled to expel the carbonic acid. To this is added enough of the original solution of the two acids to make it distinctly but faintly acid. Then a solution of calcium chloride is added, and this precipitates all of the tartaric acid. The filtrate from this precipitate contains calcium citrate, which separates if the solution is boiled.

AFTER the dust has been thoroughly beaten out of carpets, and they are tacked down again, they can be brightened very much by scattering corn meal mixed with coarse salt over them, and then sweeping it all off. Mix the salt and meal in equal proportions.

APPARATUS FOR THE MANUFACTURE OF GAS FROM OIL.

Professor Henri Hirzel, of the University of Leipzig, constructed in 1862 his first apparatus for the manufacture of gas from oil, this, as well known, being derived from the distillation of the residue of petroleum, of oil of lignite—tar—of schist, etc. The apparatus has been successively improved, and a type is now being constructed which gives very satisfactory results.

We give a view of a plant (less the gasometer, which is not shown) in the accompanying cut, which is equally well adapted for private use and for supplying gas to light an entire city. Of the apparatus under consideration, A, is the furnace of the retort, B, and L is the reservoir containing the oil, which passes through the siphon, *a*, before entering the retort, which has previously been raised to a cherry red heat. The supply for this retort is regulated with precision, and so that the quantity of material entering shall always correspond to the intensity of the distillation. Owing to this *modus operandi* the retort remains constantly empty, and the manufacture may be stopped at any instant by closing the cock on the pipe leading from the reservoir, L. R and R are pressure gauges for indicating the amount of pressure of the gas in the retort and at the condenser. The products of distillation that are obtained at B rise through the pipe, D, which is bent at its upper part, and enter the main, E. Here they traverse a layer of tar, which entirely closes the plunge pipe, D, in order to prevent the gas from returning from the gasometer to the retort. The quantity of tar should always remain the same in the main, E, and, as the gas parts with some through the effect of bubbling through it, the principal pipe, F, debouches at the level of the surface of the liquid and thus serves to allow of the simultaneous passage of the gas and overflow of tar, which latter then enters the condenser, G, filled with coke. The oil vapors circulate in this apparatus and become cooled; the tarry compounds condense therein; and the resulting liquid flows into a receiver located beneath the condenser. On leaving this latter, the gas traverses the purifier, J, which frees it from all foreign matter, and finally reaches the tank of the gasometer through a pipe which branches off at the cock, K.



IMPROVED OIL-GAS APPARATUS.

One of the interesting parts of the furnace, A, is a second retort, which is U-shaped, and which is called by the inventor a "multiplier." This is fixed in the walls of the furnace, and filled with pieces of coke of about the size of a walnut. It is heated to a cherry red heat by the flames from the fireplace of the principal retort. During the process of manufacturing the gas a small stream of water is allowed to flow continuously from the reservoir, M (100 to 120 drops per minute), into the pipe of the siphon, Q, which communicates with a branch of the retort, S. This water is converted into steam which goes from one compartment to the other of the retort, traversing as it does to the incandescent coke, and becomes decomposed into hydrogen and carbonic oxide. It is not, then, steam that passes through the pipe, *b*, to enter the principal retort, B, but, rather, hydrogen gas and carbonic oxide. These latter mix with the oil vapors, and, through the action of the former, a large part of the carbon contained in the products of distillation forms illuminating gas. Thus by the use of the "multiplier," a less quantity of tar is obtained and 7 to 10 per cent of gas is recovered. The gas thus obtained is free from sulphurous and nitrous admixture. It is to its composition that it owes its property of remaining aeriform during excessive cold and under a high pressure. It gives an excellent light for railroad cars, and may be employed, like coal gas, in gas motors and for the different applications of heating.

Oil gas burns with a white and brilliant flame. It requires, for a light of an intensity of 10 candles, 30 liters per hour, while an ordinary gas flame consumes from 112 to 120 liters.

It has been found that a single cubic meter of oil gas will supply from 33 to 35 burners per hour with a brilliancy equal to that given by 10 candles. In an apparatus with spherical retort of medium size (weighing 200 kilogrammes) it takes, in order to obtain 100 cubic meters of oil gas:

166 kil. paraffine oil at 11 francs	18·26
230 " of coal " " 2 "	4·60
15 hours of labor " 0 40 "	6·00
Expense of maintenance	5·00
Total	33·86

Consequently the cost of one cubic meter of the gas amounts to 33·8 centimes, or one centime per burner per hour.

According to information given us by the inventor, the spherical retort presents several advantages; it extracts the largest quantity of gas from the residues submitted to distillation, it becomes red hot very quickly, and it preserves its normal temperature without requiring much fuel.—*Revue Industrielle.*

APPARATUS FOR DISTRIBUTING DREDGED MATERIAL.

We give an engraving of an improved apparatus for elevating and distributing dredged materials, and for carrying them to any distance for filling low grounds. It is the invention of Ex-Commander Henry H. Gorringe, of this city. A float carries the elevating apparatus and motor for driving it, and supports the distributing apparatus, which may be extended to any distance. A scow accompanying the float has a valve in the bottom, which may be opened to admit more or less water for mixing with the material to form a semi-fluid mass. The float has one side deeper than the other, to give it greater buoyant force, and to allow of a shallow side which may be moved closely to the shore.

The dredged materials carried by the scow are raised by the buckets on the endless chains, and discharged into the long chute which conveys them to the distributing apparatus on shore. The distributing trough has in the bottom a series of openings provided with slides, which are opened more or less, according to the rate at which it is desired to discharge the material at a given point. The trough also contains a series of diaphragms, which are drawn through the trough by means of a chain or rope.

GORRINGE'S APPARATUS FOR ELEVATING AND DISTRIBUTING DREDGED MATERIAL.

By the admission of water to the scow the material can be given any desired consistency, so that it will flow without manipulation to the elevating buckets, from the buckets through the trough to the distributer, and through the distributer to the first open gate. The diaphragms serve to agitate the material and give it a forward movement, in case the inclination is not sufficient for it to flow freely, and in cases where not needed a greater or less number of diaparagms may be removed. By keeping the material in a semi-fluid state it distributes itself more evenly over the space to be filled in, and thus saves the labor of leveling. The water will run back into the river, leaving the material uniformly spread over the surface.

With this apparatus the cost and labor of elevating and distributing dredged and other materials are reduced to a minimum.

Progress of the Tunnel under the Mersey.

Rapid progress is now being made with the tunnel of the Mersey Railway, and nearly seven hundred men are employed night and day upon it, working in eight hour shifts, from four faces. The tunnel will be 3⅛ miles in length. The drainage headings are about 100 yards in advance of the main headings, and will act as reservoirs into which the water from the main tunnel will be drained and run off to both sides of the Mersey, where pumps of great power and draught will bring the water to the surface and into the river. The excavations of these drainage headings at the present time extend about 100 yards beyond the main tunnel works at each side of the river. The drainage shafts are sunk to a depth of 180 feet, and are below the lowest point of the tunnel, which is drained into them. Each drainage shaft is supplied with two pumping sets, consisting of four pumps, viz., two of 20 inches diameter, and two of 30 inches diameter. These pumps are capable of discharging from the Liverpool shaft 6,100 gallons per minute, and from the Birkenhead 5,040 gallons per minute. These pumps will be required for the permanent draining of the tunnel. The levels give a minimum thickness of 25 feet, and an average thickness of 30 feet, above the crown of the tunnel. The depth of the water in one part of the river is found to be about 72 feet; in the middle about 90 feet; and as there is an intermediate depth of rock of about 27 feet, the distance is upward of 100 feet from the surface at low water to the top of the tunnel. One of Colonel Beaumont's boring machines has been brought into requisition, and is expected to carry on the work at the rate of 50 yards per week. The depth of the pumping shaft is 170 feet, and the shaft communicates direct with the drainage heading. This circular heading has advanced about 737 yards. It is 7 feet in diameter, and the amount of it under the river is upward of 200 yards on each side. The main tunnel, which is 26 feet wide and 21 feet high, has also made considerable progress at both the Liverpool and the Birkenhead end. From the Liverpool side the tunnel now extends over 430 yards, and from the opposite shore about 590 yards. This includes the underground stations, each of which is 400 feet long, 51 feet wide, and 32 feet high. The tunnel is lined throughout with brickwork, some of which is 18 inches thick, composed of two layers of blue and two of red brick, and toward the river this brickwork is increased to a thickness of six rings of bricks—three blue and three red. The tunnel arch has a 13 foot radius, the side walls a 25 foot radius, and the invert a 40 foot radius.

Telegraph Wire Struck by Lightning.

The *Electrician* is informed thus by an eye witness: "On March 1, near the village of Lacofranco, a flash of lightning struck the line wire about midway between two poles. The current divided and rushed along the wire to either pole, completely destroying the whole of the wire short up to the insulators, where, with a loud report, it jumped to the iron poles and made earth. The length of wire destroyed was eighty-five yards. The size of wire was No. 8 B. W. G., galvanized iron. The two ends have a purplish hue, and are like hardened steel. The cups of the insulators (white porcelain) were broken, the upper parts being covered with a purplish, metallic looking coating, radiating from where the line was attacked. The coating is thoroughly burnt into the glaze. The inside of the cups, nearest to where the electric fluid sprang from the line to the iron pole, is covered with a fine, dark, metallic looking deposit, which is also burnt into the porcelain."

THE American Bell Telephone Company has, it is said, erected 2,000,000 miles of overhead wire during the past year.

THE WOODPECKER.—(*Picus.*)

A Linnæan genus of birds, now divided into a number of genera, and belonging to the family *Picidæ*, of the order of *Scansores*.

The woodpeckers, whose name indicates their habits, are widely diffused over all quarters of the globe, excepting Australia.

There are several well marked groups of woodpeckers, differing in form, plumage, and habits, which also are of different geographic distribution; some of them entirely and some chiefly confined to particular parts of the world.

Prominent among the species of Europe are the great black woodpecker (*Picus* or *Dryocopus martius*). It is about sixteen inches long, black, with a red cap on the head. It is to be found in the pine forests of the Continent, and is rarely seen in the British Islands.

The most plentiful of all the British species is the green woodpecker (*Picus* or *Gecinus viridi s*). It is found in the woody parts of Scotland and England, but is rarely found in Ireland. It is common on the Continent of Europe from Scandinavia to the furthest south. It is about thirteen inches long, and is mostly of a dark green color, tinged with yellow; the feathers over the nostrils and around the eye, black; the crown and back of head bright scarlet; a black mustache extending backward and downward from the base of the lower mandible, with a brilliant scarlet patch along the center of it; the edges and tips of wings spotted black and white.

The American species are very numerous, some of which are among the best known birds of the United States and Canada, such as the hairy woodpecker (*Picus villosus*), which is to be found at all seasons of the year in woods, fields, orchards, and even in the midst of large cities, and visiting farmyards in winter to pick up grain, etc., a lively, noisy, and active bird.

Ivory-billed woodpecker (*Picus* or *Campephilus principalis*), which inhabits the dense woody sections of the southern part of the United States and Mexico. They are called by the Spanish *carpentero*, for the great quantity of chips which they make. They are valued by the Indians for their ivory-like bill and scarlet crest, which they use as ornaments. While this bird is found in southern locations, it has been seen as far north as Maine.

The red-headed woodpecker (*Picus* or *Melanerpes erythrocephalus*) is very common in most parts of North America. It is a very destructive bird, feasts much upon fruit and upon the young heads of Indian corn. In some sections a reward is given for its destruction.

The largest species in the northern parts of America is the black woodpecker, or log cock (*Picus* or *Dryotomus pileatus*), which is about eighteen inches long, the general color greenish-black, with stripes of white from eyes along neck and sides.

The genus *Picumnus* is the type of a group of *Picidæ* called *Piculets*, very small birds, with bill hard or horny at tips; broad, round wings, and short tail, with broad, rounded feathers, not used for support, departing from the typical characters of the family. They inhabit the warm parts of South America, India, and the Eastern Archipelago.

The great spotted woodpecker (*P. major*), also called the French pie and wood pie, of which our illustration gives an accurate representation, is not uncommon in some parts of England, but is rare in Scotland. It is found on the Continent from Norway to the Mediterranean. It is about nine inches and a half in length; the color is black, varied with white; the under parts grayish white; the back of the head of the male bright scarlet. Here let it be noticed that the general color of the plumage of the family *Picidæ* has a tendency to resemble the bark of trees on which they are seen. One is often surprised, in passing through a wood suddenly, to be startled by a wonderful succession of raps, something like the rattle we see children play with. Suddenly it stops, and upon looking around you at last discover pieces of bark falling but a short distance from you, some of large size. A instant later the eye catches sight of the cause of all our previous fright; in an instant it disappears, leaving us in a new train of thought over the wondrous workings of the productions of the divine Creator.

The lesser spotted woodpecker (*P. minor*) is widely distributed in Europe and the north of Asia. Its colors are similar to those of the last species described. In size it is about five and three-fourths inches long, and is to be often seen searching for insects in orchard tree branches.

We have now described the principal varieties of this peculiar species of biped, and will proceed to give the natural characteristics.

They subsist chiefly on grubs and insects which they dig out of decayed trees or from discovery under the bark. For this purpose their whole structure is admirably developed; the bill is long, sharp, and powerful, with a hard tip and sides compressed; the tail is usually lengthened and rigid, although in some it is short and rounded; the vertebræ of the neck are greatly developed. The formation of the feet and legs is such that the birds are able to grasp the trees firmly with the feet, while swinging their full force of body against it; the toes being in pairs, two before and two behind, with sharp, strong claws; the whole structure adapting these birds to run and climb with the greatest rapidity on the stems and branches of trees, in which they aid themselves by their tail, like creepers, in their search for food.

Thus, while natural facility for climbing is perfect, their powers of flight are very moderate. Another most singular point in the woodpeckers is the method by which they are enabled to thrust the tongue deep into the crevices and bring out any insect that may be there. The tongue is constructed with two elastic ligaments which are inserted near the juncture of the upper mandible with the skull; thence they sweep around the back of the head, and, passing under the lower mandible, enable the tongue to be thrust far out beyond the bill, its tips being horny and furnished with barbed filaments, while the surface is covered with a glutinous saliva secreted by two large glands, thus causing those insects to adhere that would be too small to be impaled.

The common notion that the woodpecker is injurious to trees is erroneous, as they do more good by preventing the ravages of insects than harm by their pecking.

They strike out chips of wood by their strong bill, and in this way enlarge holes in decayed parts of trees for roosting places, usually selecting a place hidden by branches or foliage, leaving in the thus made opening a few chips for a flooring to the nest; the remainder are carried away to a distace for apparent safety, that the breeding place of their young will be less liable to discovery.

Of the woodpecker many anecdotes are told, relative to its persistent pecking and natural restlessness while in captivity. Among them we may mention that Alexander Wilson, the American ornithologist, had an ivory-billed woodpecker in his possession which pecked lath and plaster in its efforts to get away, and utterly ruined a mahogany table to which it was fastened.

THE WOODPECKER.

The Hairy Woodpecker.

A beneficent Providence has richly endowed the family of woodpeckers with qualities of rare excellence and worth. Especially is this true, says the *American Naturalist*, of the hairy. The principal count in the indictment against him, that he bores the bark of fruit and other trees in order to feed upon the sap and inner bark, will not stand, being utterly false. An extended examination of the contents of the stomach of this bird invariably fails to disclose an appreciable amount of either, but in their stead a huge mass of insects and larvæ. The perforations which he makes are merely for the purpose of securing his quarry from their ensconsure neath the bark out of the reach of other agencies. His is a work of destruction and death—the dislodgment and consuming of myriads of borers, etc.—not harm to the tree, but beneficial, as attested in innumerable instances. In this despised, persecuted bird we have a true friend and effective co-worker, very materially assisting us in gathering an ample return of perfect fruit for the labor and care expended to this end in orchard, vineyard, or garden. Ignorance and prejudice have no place amid the general intelligence and humane principles of to-day, and should not be tolerated. Let no one, then, wantonly destroy either eggs or parent bird, but carefully foster and protect them, even using his influence to secure the punishment of all thus rendering themselves amenable to law and the just condemnation of every intelligent person.

Formation of Arsenides by Pressure.

Spring has continued his experiments on the formation of chemical compounds by simple pressure, and now gives the results obtained with arsenic. When zinc filings and pulverized arsenic, mixed in the proportions required by the formula Zn_3As_2, are submitted to a pressure of 6,500 atmospheres, a homogeneous metallic-like block is obtained, crystalline under the microscope and brittle under the hammer. It dissolves completely in sulphuric acid, evolving hydrogen arsenide and leaving only a small black residue. A similar mixture of lead and arsenic gives a homogeneous block of a metallic luster, hard and brittle, and which does not clog the file. The arsenide of tin corresponding to the formula Sn_3As_4, thus obtained, is a white metallic mass, brittle with foliated structure, fusible at a higher temperature than tin, and difficultly soluble in hydrochloric acid with evolution of H_3As. The cadmium arsenide required three pressings, and gave a brittle metallic mass. No compound of as high a composition in arsenic, Cd_3As_2, could be formed by fusion. Copper combines with arsenic under pressure only with difficulty. After eight pressings a homogeneous metallic mass resulted, brittle and granular, grayish-white in color. Silver acts similarly, giving a bluish-gray homogeneous metallic mass. Arsenic itself, when submitted to 6,500 atmospheres, acquired a metallic luster and a specific gravity of 4·91.—*Ber. Berl. Chem. Ges.*

The Perils of the Studio.

A contemporary directs attention to certain dangers which attend the art of painting, or, rather, which may attend the practice of that beautiful art, if habits of carelessness and uncleanliness are formed, especially in the case of young females who take to painting either as a pastime or a profession. The censor cited warns his readers, first, against putting the brush in the mouth to make a fine point, and, second, against leaving the handles of the brushes dirty, so that when several are held together in the hand the paint may be absorbed and poison the system. He enjoins the entire avoidance of brush pointing with the mouth, and the perfect cleaning of brushes before they are put away. In support of his argument our contemporary refers to certain instances of injury which have recently occurred. It is needless to say that perils of the class named actually exist. If an onlooker will take the trouble to count the number of times an amateur artist or beginner puts the brush in the mouth during one-quarter of an hour, the result will make it clear that a considerable amount of lead or other poisonous material may be taken into the system by this process. As to the alleged absorption through the skin of the hand, we do not remember to have seen an instance of wrist-drop in an artist arising from this cause, but it is quite conceivable that such cases may occur. It will therefore be well to bear the warning given in mind, and to avoid practices which may, under certain conditions, prove mischievous. There is another small matter which should be mentioned in this connection. It is a mistake to keep the left hand burdened and cramped by a heavy palette and a bundle of brushes with the rest-stick in oil painting. The hand gets cramped and painful. It is possible that in some cases a paralytic disability not unlike writer's cramp may be induced by this mismanagement. The practice might, though not perhaps easily or conveniently, be avoided.—*Lancet.*

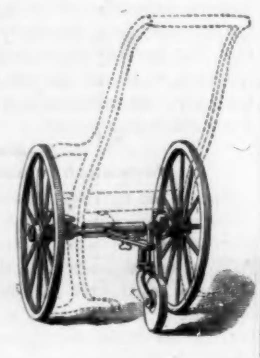
New Invisible Ink.

C. Widemann communicates a new method of making an invisible ink to *Die Natur*. To make the writing or the drawing appear which has been made upon paper with the ink, it is sufficient to dip it into water. On drying, the traces disappear again, and reappear by each succeeding immersion. The ink is made by intimately mixing linseed oil, 1 part; water of ammonia, 20 parts; water, 100 parts. The mixture must be agitated each time before the pen is dipped into it, as a little of the oil may separate and float on top, which would leave an oily stain upon the paper.

RECENT INVENTIONS.

Improved Invalid Chair.

The engraving shows an improved attachment for chairs, which will convert an ordinary chair into an invalid chair, which can easily be moved about. Journal boxes are attached to the bottom of a chair near the front, and at the sides wheels are provided, with fixed axle sections, which are passed through the journal boxes and into the opposite ends of a tubular journal box held transversely under the chair seat, at the end of a longitudinal bar attached to a bracket frame secured to the bottom of the chair seat at the rear. The front end of this bar is slotted longitudinally, and a thumb screw passes through the slot into a projection of the tubular journal box. By this construction the bar and the projection of the tubular bearing are adjustably secured together, thereby permitting the large wheels and caster wheel to be coupled closer together or farther apart to suit different sizes of chairs. Collars provided with binding screws are loosely mounted on the axle sections. The axle sections are passed through the journal boxes and into the ends of the middle journal box, and are held in place by the collars, one of which is placed against each side of the outer journal box. The shaft of the caster wheel can be so adjusted that the chair can be inclined backward more or less, as may be desired. The wheels can easily be attached to and removed from any chair of any width. This invention has been patented by Mr. M. J. Koenig, of Jersey Shore, Pa.

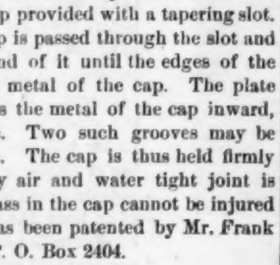


Fuse Cutter and Capper.

This is a new device for cutting fuses and securing explosive caps on the ends of the same. The pliers have three transverse grooves in the inner surfaces of each jaw, the middle ones being made tapering. The outer groove of one jaw contains a cutting disk, which is secured transversely in the groove, and which, when the jaws are closed, passes into a groove in the opposite jaw. This disk is used to cut a fuse, which is placed in the groove of the opposite jaw. The end of the fuse cut off in this manner is placed between the jaws of the pliers and within the tapering grooves, and is pressed between the said jaws, thereby tapering the end of the fuse. An explosive cap is then placed on the end of the fuse, and the fuse and the cap are placed between the jaws and in the inner grooves, and the inner end of the cap is pressed on the end of the fuse. The fuse and the cap are held between the jaws of the pliers in the grooves, and then annular grooves are formed in the inner end of the cap to hold the cap on the fuse, and part of the metal of the cap is forced into the fuse by means of a metal strip provided with a tapering slot. The projecting end of the cap is passed through the slot and moved toward the narrow end of it until the edges of the slot press firmly against the metal of the cap. The plate when turned gradually forces the metal of the cap inward, forming an annular groove. Two such grooves may be made in the cap if desirable. The cap is thus held firmly on the fuse, and a perfectly air and water tight joint is formed, and the explosive mass in the cap cannot be injured by water. This invention has been patented by Mr. Frank P. Picking, Denver, Colo., P. O. Box 2404.

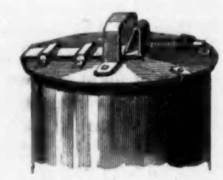
Improved Center Board.

We give an engraving of an improved center board for vessels recently patented by Mr. William O. Christensen, of Marshfield, Coos Bay, Oregon. The object of this invention is to provide a center board having a greater area of resistance than those of ordinary construction, and having means for operating it with great facility. This center board consists in two boards located on opposite sides of the keel, and connected by rods which pass up through openings in the bottom of the vessel with machinery on the deck, by which they may be easily operated. The application of this improvement does not necessitate cutting away the timbers, nor any other material change in the vessel. The board being entirely below the vessel, valuable cargo room is saved. Fig. 1 shows the vessel with center board attached, and Fig. 2 is a transverse section of the keel, keelson, and center board, showing the operating rods and the well that incloses them.



Lid for Pots, Barrels, etc.

The engraving shows an improved device for securing a lid on a pot, barrel, or other receptacle. The pot is provided at its upper edge with a bead, and on the lid there is a sliding bolt, having at one end a hook adapted to catch on the bead on the edge of the pot, and the opposite or inner end of the said bolt is turned upward to form a handle piece, which is below or adjoining to the usual handle provided on lids. A spiral spring is attached to the inner end of the bolt and to a clip fastened on the lid. Opposite that part of the lid from which the hook projects the lid is provided with two hook clips adapted to catch on the annular bead. The spring draws on the inner end of the hook bolt, so that the hook will be pressed against the bead on the edge of the pot and hold the cover fast. When the handle of the lid is grasped, the sliding bolt is easily operated by the thumb or one of the fingers. This invention has been patented by Mr. Peter D. Conneely, of Horseheads, N. Y.



Workshop Virtues.*

The possession of what may be characterized as workshop virtues is a valuable qualification to all employed on engineering or mechanical work, and naturally the absence of this qualification is a serious detriment. A few words, therefore, may serve as hints to apprentices and others desirous of acquiring these virtues, for, after all, they are greatly matters of habit, and can be acquired. Observation, punctuality, method, readiness, and knowledge of principles are the most prominent workshop virtues.

Observation is the first lesson the apprentice learns. When fresh from school he is introduced into a new world (the workshop), and sees about him a number of men and of tools, and of the names of the latter, or their uses, he knows practically nothing. Machines, wheels, and shafts, some in motion and others at rest, stare him in the face until he is somewhat bewildered, and he is apt to exclaim, like the "heathen Chinee," who was viewing a marine engine for the first time, "Too muchee wheelee, make man thinkee too muchee." After a day or two this feeling of bewilderment fades away—use becomes second nature to him. Now is the time to improve himself and awaken his faculties, if he has the will. Let him observe the various machines and processes, try to understand why one machine runs at one speed and another at a different one, and why one process is dependent upon another—in fact, make use of his powers of observation, try to remember what he sees, and consider whether he can suggest an improvement. If he can make notes at home of an evening, so much the better; he will find the habit exceedingly useful. By observation, errors may be detected in work about to be executed before the blunder is actually committed, thereby saving both time and money.

All improvements in machinery arise primarily from observation. It is the foundation, and is the basis of all the known facts in physical science. The facts are first observed, then recorded, and afterward deductions made from them. The observing man is continually acquiring information, storing up its observations, which at a later day are sure to be useful, both to himself and his fellows. The observation of James Watt led to the great improvements in the steam engine. The observation of Humphrey Potter led to the invention of the hand gear for pumping engines.

In the workshop there are still remaining rules of thumb, relics of the past, which are upheld by the lover of precedent, who can only give one reason for his actions, viz., that the work has always been done in that way. The young apprentice will not, as a rule, get much help from his fellow workmen when he tries to suggest any improvement on old fashioned practices, and, we regret to say, from but few employers. One notable exception may, however, be mentioned: that of Messrs. Denny Brothers, shipbuilders, Dumbarton, who have instituted a system of awards to their workmen for any invention or improvement introduced or suggested by them, and by means of which work can be rendered either superior in quality or more economical in cost.

In spite of the difficulties that the young engineer will encounter he must not give in, but continue to observe, and store up his observations for future use, under the name of "experience." We next pass on to the second workshop virtue, "punctuality." In some measure all workmen are obliged to be punctual in their going to and leaving work. The bell rings or the whistle blows at fixed hours, and the workmen must be governed by these signals; but, over and above these fixed times, the habit of punctuality is a valuable one. Some factories are famous for being faithful in the fulfillment of their promises as regards time of delivery; they will work night and day to complete an order by the specified time. Others, again, are noted for their utter disregard of time; they are old fashioned, and happy-go-lucky. If the work gets done, "well and good;" and if not—"well, it cannot be helped."

In this connection an anecdote in the career of Sir John Brown (Sheffield), who has always been known as honest, thorough, and punctual, is worth repeating. In the early part of his career he happened to be in Edinburgh when the Edinburgh, Perth, and Dundee Railway was about to be opened, and chanced to call on Mr. Grainger, the engineer of the line. Everything was in readiness except a few sets of springs, which the contractor was unable to supply; and as it seemed impossible to get the articles required in so short a time, it looked as though "the ship was going to be spoiled for the want of a pennyworth of tar." Mr. Grainger mentioned the matter to his visitor, and in sheer desperation asked him if he could supply the springs by Thursday. This was on the Saturday, and Mr. Brown replied that, considering the imperfect carrying communication, he feared the time was too short. "Well," rejoined Mr. Grainger, "we must have them."

John Brown considered a moment, and then said, "You *shall* have them." He started forthwith to Berwick, took the train and coach for Newcastle, and thence to Sheffield, which he reached at eleven o'clock P.M. on Sunday. Here he went straight to his foreman, and told him to have the men there the first thing in the morning, and gave positive orders that the springs were to be ready on Monday night. The goods were packed at the appointed time, and the maker hurried off with them to Manchester. Here he had arranged to have a wagon ready to convey the springs to the station from which the mail for the North started. He was in time for the train, but when he presented his consignment a new difficulty met him in the refusal of the officials to load such goods in the mail. Mr. Brown went straightway to the manager, told him his case, and got a horse box put on to convey the springs. After a devious journey, and notwithout many threatening *contretemps* and anxious moments, the traveler reached Glasgow, *via* Ardrossan, at five o'clock on the Wednesday afternoon, to the amazement and gratification of Mr. Grainger, who not only compensated the enterprising manufacturer for his outlay and pains, but also introduced his feat to the notice of most of the railway directors present at the opening ceremony, and the gallant effort threw into John Brown's works for a considerable time the bulk of the Scotch trade in railway material. It cannot be too much impressed upon all in the workshop that time is money, and punctuality is economy of time.

Method, or system, is the next workshop virtue we shall touch upon. This is not given to all men to possess. Some men have no system; they are always in a muddle. At times they get hopelessly blocked, and others have to put them straight. Method implies foresight and a logical mind. A man must think of his work, and arrange it beforehand to the best advantage. A works manager without method is useless. He will have his smithwork done before his patterns are begun, one set of men will be waiting for another set, his work will always be behindhand, and the cost of production greater than that at a works where there is a good system.

Readiness is perhaps not so apparent a virtue as the others we have mentioned, but every foreman or manager knows how pleasant it is to deal with a workman ready at taking a new idea, or willing to try a new method of doing work. These are the men who distinguish themselves, and obtain better positions than those who cannot move out of their rut of habit. So, also, a firm becomes noted for adapting itself and its resources to new trades or methods of doing work, while a firm which will not try an experiment will be pushed out in the cold in the struggle for existence. Knowledge of the principles involved in workshop practice is the last of the workshop virtues we shall refer to. The man who knows the reason for what he does is a better man than he who only does a thing because he is told to do it a certain way. Every mechanic should understand, for example, why his drill should run faster for a small hole than for a large one, why one speed of tool is suitable for one metal and not for another.

If he is a smith, he should know why steel is worked at a lower heat than iron; what conduces to a sound weld, and why a piece of steel broken haphazard off a bar cannot be drawn to a sharp point without certain precautions. There are principles underlying every trade which it is to the interest of the artisan to study, to ponder over, ay, and even to discover, for it is well known that there are principles yet undiscovered which the cultivator of the various workshop virtues may be lucky enough to fathom, with honor to himself and benefit to mankind at large.

* The *Mechanical World*, London.

Strengthening a Foundation.

An interesting way of strengthening a weak foundation was recently tried on a new building that suddenly commenced to settle. The excavation for the walls had been carried down until a mixture of coarse sand and gravel was found, which was deemed suitable. During a heavy rain water found entrance to the cellar, when the sinking resulted. The building was braced, the cellar, drained, and then the inside wall of the foundation was uncovered down to a little below the bottom. A Λ-shaped piece of masonry having a height of about twice the width of the base was then built, the bond between it and the wall being carefully looked to.

After this had been finished upon the inside, it was repeated upon the outside. The base of each of these pieces was equal in width to that of the wall, so that the operation practically trebled the bearing surface of the foundation. It may be well to add that the water will not again be permitted to enter that cellar, as every passage way has been securely closed.

THREE factories in the United States consume nearly two million eggs a year in making the peculiar kind of paper used by photographers known as albumen paper.

ENGINEERING INVENTIONS.

Mr. Abraham Ayres, of New York city, has obtained a patent on improvements in railroad switches of the kind that are operated by the weight of the car horses. The depressing levers under a platform to change the switch rail mechanism is simple in its construction and operation, and promises to be a valuable acquisition to the class of inventions to which it belongs.

Mr. John Taylor, of Halifax, Nova Scotia, Can., has patented an apparatus for purifying foul ammoniacal liquors which is mainly designed to be used in connection with gas works, and has for its object the purification of crude gas by means of the ammonia contained in it. Cold or heated atmospheric air is forced through the foul gas liquor for the purpose of expelling the sulphureted hydrogen.

Mr. J. M. Higbe, of Manson, Iowa, has patented an automatic variable cut-off valve gear of very simple construction. The valve rod is so connected to the crank shaft as to shift toward and from the center, to lengthen and shorten the travel of the valve, thereby varying the cut-off. Very simple mechanism is employed by Mr. Higbe for controlling the motion of the engine and economizing the steam.

An improved tool for cutting slots in the flanges of railroad rails, intended especially for use in repairing the track, has been patented by Mr. James K. P. Renfroe, of Prentiss, Ga. The end of the rail to be slotted is placed upon an anvil, and the punch with one of its cutters resting upon the flange of the rail is struck with a sledge hammer, and a clean, square cornered cut in the flange of the rail is the result.

Mr. J. M. De Witt, of Greeley, Colo., has patented a useful, but very simple improvement upon the ordinary car brake. The usual ratchet wheel and pawl is employed. A lever is pivoted upon the same pin as the pawl, and a semi-elliptical spring is secured to this lever in such a way that by operating the lever the spring will act upon the pawl to cause to engage or disengage the ratchet wheel of the brake.

A device for depositing torpedoes in snow banks to clear the tracks for railroad trains has been patented by Mr. George A. Gunther, of Brooklyn, N. Y. The invention consists in a pole or other analogous device attached to the front end of a locomotive or car, which pole is forced into a bank of snow and carries a torpedo or other explosive cartridge into the bank and holds it in there until it is exploded.

A patent has recently been granted to Mr. James W. Cole, of Huntington, Mass., for an improved car coupling. This consists of a drawhead having within it two hinged coupling blocks connected by rods, and provided with a coupling pin secured to one of the blocks. The drawhead is provided with guides and guards to direct the link into the space between the coupling blocks. The upper block carrying the pin projection is raised for uncoupling by means of a chain passing to the top of the car or to bar extending to the sides of the car.

A very simple automatic car coupling has been patented by Mr. E. C. Eyl, of Jefferson City, Montana Ter. A T-headed coupling hook is pivoted in a slotted drawbar, which is attached to the car body, and hook-headed jaws, held together by a spring, are so pivoted that when the head of the coupling hook comes in contact with these jaws, they will be opened laterally and receive and hold the male coupling head. The uncoupling is accomplished by raising the head out from between the jaws either from the side of the car, or by a chain extending to the roof.

An improvement designed to facilitate the unloading of flat dumping cars, such as are employed for transporting gravel, coal, etc., has been patented by Messrs. John Smith and J. R. Rhodes, of Rockville Center, N. Y. A movable frame upon which the load is placed is mounted upon rollers, journaled upon an ordinary car frame. The movable frame is shifted to the side of the car by means of a stationary gear wheel which is journaled to the car frame and engages with a rack-bar attached to the movable frame. This frame is provided with stops to limit its lateral movement and prevent its completely overturning when tilted in discharging its contents.

Messrs W. H. Snyder and A. O. Frick, of Waynesborough, Pa., have patented a device for application to traction engines. It is customary in traction engines to have the two main wheels driven independently, so that in turning a curve the inner wheel will be stationary while the outer wheel is rounding the curve. This is accomplished by means of a compensating gear of proper construction. Sometimes it happens however, that one wheel will get in a mud hole or unevenness in the ground, at which time the wheel so placed spins around, and the power of the engine will be lost. By the device patented by Messrs. Snyder and Frick, however, the loose wheel may, when required, be rigidly locked to the axle, so that in such case the power of the engine cannot be diverted to one wheel, but both are rotated together, and the wheel on the hard ground is made effective for drawing out the engine.

MECHANICAL INVENTIONS.

A silk throwing machine to be used in spinning, doubling, and respinning silk and other fibers has been patented by Mr. J. E. Tynan, of Paterson, N. J. This is accomplished by this improved machine in one continuous operation, and greatly facilitates and economizes the labor of silk spinning.

Letters patent have recently been issued to Mr. O. R. Mehaffey, of Richburg, N. Y., for coupling for pump rods, the object of which is to provide an improved coupling for the sucker rods of pumps, by means of which coupling the rod sections can be coupled and uncoupled very rapidly.

A crank motion attachment which may be adapted to any common ice cream freezers ordinarily worked by hand has been patented by Mr. D. S. Coskrey, of Troy, Ala. It can be fastened to any table or bench, and by extracting the shaft through a hole in the table connection is readily made between the freezing vessel and the crank mechanism.

Mr. W. C. Bush, of Brooklyn, N. Y., has recently patented an improved fire escape ladder, which can be wound upon a drum, is flexible in one direction, and stiff in the other, and which is provided at its lower end with a foot piece which automatically adjusts itself on the ground and forms a support for the ladder.

An improved crib for children has been patented by Ida R. Opdyke, of Plainfield, N. J. The crib is provided with a movable side which slides vertically in grooves in the side posts of the bed. Balancing weights are provided, which pass over pulleys in the posts mentioned. The side is secured in its raised position by fastenings suitable for the purpose.

A self-closing faucet has been patented by Mr. T. H. Walker, of Kansas City, Mo., which consists in so seating a valve in the upper part of the chamber below the nozzle of the faucet that the flow of water will be regulated by the depression of the spring, which retains the valve home, so that the flow is stopped by the action of the spring upon the valve, and by the upward pressure of the water against the bottom of the valve.

Mr. E. H. Leland, of East Templeton, Mass., has patented a novel turning lathe which consists of an apparatus for automatically lifting the lever that clutches the feed nut with the feed screw in automatic lathes for turning chair stocks; and in an automatic contrivance for setting the lifting contrivance, the object being to save the attendant the labor of lifting the lever each time a new piece is put in the lathe.

An indicator, for hotels, to show whether the rooms are occupied or otherwise, has been patented by Mr. Benjamin S. Hering, of Cambridge, O. This improvement consists of a series of slides, each operated by a button and each provided on its outer end with the number of a room, a slide being moved backward to conceal the number of a room when taken, and moved forward to expose the number of the room when empty.

A novel device for advertising consisting in the use of a windmill of peculiar construction, is the subject of a patent granted to Mr. Thomas B. Peacock, of Topeka, Kan. The inventor provides a cylinder on which the advertisement is displayed, and by suitable gearing he operates grotesque figures and bells, triangles, drums, or other musical instruments for attracting the attention of the passing public, all of which are operated by any ordinary windwheel.

Mr. R. L. Pruyn, of Baton Rouge, La., is the patentee of a new fire escape which consists in a basket or car upon rails, which are supported by brackets from the wall of a building, and in providing the basket with suitable tackling, whereby it may be raised and lowered as desired, and also shifted along the rails under the row of windows in the building. The hoisting rope or chain is provided with a brake mechanism for regulating the speed of descent of the basket.

Messrs. E. Phillips and S. A. Kealy, of Lewisville, Texas, are the inventors of an improvement in bolting reels for flour mills. The bolting reel is constructed in two sections secured to a two-part shaft. The bolting cloth extends from one wheel to the other, and so secured as to prevent the cloth from slipping out of the groove of the wheel when put under tension. Braces are also provided for preventing sagging. The reel frame is constructed entirely of metal, is very light and durable.

Mr. Ludwig Mautner, Ritter von Markhof, of Vienna, Austria-Hungary, has patented a new furnace and apparatus for drying and roasting malt, etc. Processes and apparatus employed heretofore for drying malt have the great disadvantage of not furnishing a homogeneous material. The purpose of the present invention is to produce a perfectly uniform product, by the very simple machinery employed. The drying and roasting can be regulated at all stages by this apparatus.

A patent for a very powerful baling press, mounted on a truck and wheels, so as to be readily moved from one place to another, has recently been issued to Mr. E. J. Bennett, of Bainbridge, N.Y. The power is communicated to the machine by attaching a team to a lever which, by the act of drawing forward, forces the follower, which is provided with segmental racks, against the material to be baled. This press is very light, quite powerful, and so constructed as not to be likely to get out of order.

A feed regulator for hemp drawing and spinning machines has been patented by Mr. J. R. Hoover, of Elizabeth, N. J. This is so constructed that when the sliver which is carried on the endless chain of the gill pins becomes large it will come in contact with the condenser, which being mounted upon the upper end of a lever rod is moved backward, whereby a brake is applied to a pulley connected with the endless chain. This checks the movements of the endless chain, and in consequence the feed of the sliver to the condenser. Thus the whole process of feeding is controlled automatically.

Mr. G. W. Tarr, of New York city, has patented an improved derrick which he claims is stronger and more durable than any derrick of the same weight and size heretofore made. The lower end of the derrick boom is pivoted into a frame, which may be raised to any elevation desired by means of chains, which pass over a pulley at the upper end of the derrick post, the chains being made in such a way as to be self-locking. The derrick boom is slotted, and is provided with pulleys in such position that the weight to be elevated may be brought to bear either upon the extreme end of the boom or lower down, where the strain will be less great.

A device which is designed to cause the automatic signaling of an approaching train at intervals along the track and at suitable distances from crossings and stations has been patented by Mr. W. R. Wood, of Bowling Green, Ky. The inventor places a pivoted "shoe" at one side of the ash box, adjacent to one of the drivers of the engine, and connects it with an alarm or signal bell in the engine cab; the shoe being adapted to engage with a cam fastened to the track tie, whereby when the shoe passes over the cam, it will be raised by the cam and the signal bell in the engine cab will be rung.

An ingenious machine for heeling boots and shoes is the subject of a patent granted to Mr. J. Sperry, of Philadelphia, Pa. The process consists in mounting a number of boots or shoes upon forms on a horizontal revolving table, so that each may be brought successively underneath a drop hammer. When in operation, the hammer descends and drives the nails through the sole and clinches them on the iron last. A finishing piece of leather is then placed on the heads of the nails, which still project somewhat, and when the hammer descends a second time the nails will be driven entirely home and the operation finished.

A machine for sizing and shrinking wool and fur felt hats has been patented by Mr. W. F. Martin, of Dannemora, N. Y. The improvement consists in arranging several convex rollers upon a movable frame, which by means of a lever may be adjusted in relation with two large concave rollers which are placed above the smaller rollers. A small convex roller is located between the two larger rollers. In operation the hats are passed between the several rollers, and a reciprocating movement is given to the lower set of rollers by the lever attachment mentioned. In this machine the process of hat making by hand is closely simulated, and the work is accomplished more rapidly by it than when done by hand.

A very ingenious machine for removing the stiff bristles from seal and other skins, and also for unhairing such skins or cutting off part of the length of the hair, has been patented by Mr. Theophil Rasmus, of New York city. The invention provides a device for stretching the fur on a plate preparatory to clipping off the bristles, and for holding the hair down for this purpose by means of a current of air which is produced by a suitable blower. Other devices are provided for moving the cutter knives toward the upper edge of the plate over which the skin is stretched, and for pressing combs against the skin after the hair has been laid down by the current of air, all these being operated by the same driving shaft.

Mr. S. D. Engle, of Hazleton, Pa., has recently patented some improvements upon an engraving machine for which the same inventor originally obtained a patent in September, 1881. A workbed so constructed that it may be adjusted to any desired inclination is attached to a bracket which slides in the standard of the machine. Upon this bed is clamped the object to be engraved. The cutting tool is suspended above the plate to be engraved and connected with a tracer below in such a manner as to follow every motion of the tracer, so that when the instrument is moved by hand over the lines of the type, which is clamped in position on the table as a guide, the cutter above will produce a similar device upon the before mentioned plate.

Mr. William E. Wild, of Candalara, Nev., has patented an improved machine for boring, drilling, and facing metals, which consists in a hollow tool carrying shaft rotating and sliding upon a guide rod, and connected with the drive shaft and the feed screw by gearing. The gear wheel attached to the hollow tool carrying shaft is provided with flanges to engage the driving gear wheel, so that the said driving gear wheel will move up and down with the hollow shaft. To the lower end of the hollow shaft is attached a plate carrying the tool holder, and so arranged that the tool holder and tool will be fed forward by the revolution of the hollow shaft. The hollow tool carrying shaft slides upon a rod attached at its lower end to the work table to guide and support the hollow shaft. Mr. Wild is also the patentee of a machine for reboring cylinders without removing them from their beds. The invention consists in a machine with a spider made with radial slots in its arms to receive the fastening bolts, and provided with radial arms to receive and support the drive shaft and the feed screw, so that the machine can be readily secured to the cylinder and the operating parts of the machine connected and held in place. To the legs of the upright frame of the machine are bolted legs provided with vertical slots, so that the machine can be readily adjusted higher or lower, as the position of the cylinder may require. The same inventor has likewise patented an improved machine for cleaning, separating, and grading grain. Several sieves are arranged in the upper part of the frame on an incline, each lower sieve being of greater length than the sieve above. An air chamber is provided for blowing away the chaff while the grain is on the sieves. A spout is secured to the lower end of each sieve to receive impurities which will not pass through the sieve, and discharge them into a receiver. The grain that passes through the lowest sieve falls upon an inclined bottom of a shoe, which guides the grain into a vertical frame which is provided with a series of inclined ribs, leaving a greater proximity to one another toward the bottom of the frame. Attached to the end of each pair of ribs are suitable spouts for guiding the grain, after it has been thus graded, into separate receivers. The frames carrying the sieves and the ribs, which are both connected one with the other, are oscillated by a pitman connected with an eccentric, upon the power shaft of the machine. This seems to be a very simple and complete device for effecting the successful separation and grading of grain. Mr. Wild has further patented a grain cleaner, grader, and separator, of entirely different form, consisting of two oscillating shoes mounted upon a frame, having a three-armed lever pivoted on the frame between them and connected with the driving power for the purpose of setting the shoes in motion. The grain as it passes through the hopper in the upper part of the frame falls through a sieve, the chaff being removed by the blowing machine, and then passes on to a series of frames provided with parallel bars, and so constructed that the larger kernels will be separated and guided into a receiver, the smaller kernels passing through to be graded in a similar manner lower down. The grain may be passed through any number of these sieves according as the work may require.

AGRICULTURAL INVENTIONS.

A very simple cutter for severing the bands of bound grain has been patented by Mr. W. B. Bowers, of Falls City, Neb. The cutter is fastened to the fingers of the hand with straps, so that in feeding the grain to a thrashing machine, one handling will suffice for cutting the bands and passing the bundle to the machine. This device is very simple and will be found useful in the handling of grain.

A simple and rapid working reaper and harvester is the subject of a recent patent issued to Mr. Benj. Hebron, of Cassopolis, Mich. This machine is so arranged as to control and direct the grain at both edges of the swath while being cut, so that it will fall upon the platform of the harvester in a proper position for a sheaf. It may also readily be adjusted to suit the height and varied condition of the grain.

An improved flexible harrow adapted especially for use on rough ground has been patented by Mr. J. D. Privett, of Oxford, Ala. Several bars holding the teeth of the harrow, are joined one to another by a link, secured to the bars by eye bolts, which render the harrow flexible, so that it will conform to the uneven surface of the field, relieving the strain upon the team, drawing the harrow, and accomplishing the work of pulverizing the grain to better advantage.

A sod cutter mounted on a sulky frame for breaking up prairie or other grass lands has been patented by Mr. F. A. Blanchard, of Cotile, La. A series of revolving cutters are suspended from a frame which is attached to the axle of the sulky, and which cut the tough sod into strips as the vehicle passes over it. A lever is located within reach of the driver, by means of which the cutter may be raised when obstacles are encountered.

A seed sower of wheel barrow construction for sowing all kinds of small seed, and provided with a cord distributer incapable of being clogged with dry seed, has recently been patented by Mr. Mason Gibbs, of Homer, Mich. Among other advantages claimed for this machine is that the seed is carried and distributed so low down that it will not be blown away by the wind, as is frequently the case where seeders mounted on carriages are used.

Mr. S. D. B. Kise, of Kingwood, N. J., is the patentee of a new cultivator which is so constructed as to regulate the depth and also to change the position of the plows, so as to direct the dirt toward or from the plant as desired. The axle of the cultivator is arched, and the guiding handles extend from and are made fast to both the bars to which the plows are fastened, and to the axle in front of the machine, which tends to strengthen the machine and keep it more under the control of the operator.

An improved machine for preparing the soil for crops of various kinds has been patented by Mr. C. H. Knapp, of Mansfield, Pa. This machine consists in two pairs of scrapers arranged firmly upon a crossbar with a roller placed behind each pair of scrapers, for the purpose of smoothing the work done by the latter. The machine is constructed in this form with the object of forming two ridges or rows at a time. A device is provided for regulating the depth at which the scrapers shall work, and also jointed arms are hinged on each side of the machine carrying markers at their ends for marking a row on either side for the guidance of the machine at the next turn.

Mr. George N. Todd, of Fort Smith, Ark., has patented an improved machine for harvesting cotton. The cotton is stripped from the plants by two series of cylindrical brushes, which are journaled one above the other horizontally to revolve in bearings in the frame. The plants pass readily between these two sets of brushes, which are located quite far apart at the front end and converge toward one another at the rear, so as to thoroughly pick the cotton from the plant. The rotary brushes are set in action by the main wheels of the machine, the whole operation except the propelling of the harvester, being automatic.

MISCELLANEOUS INVENTIONS.

A self-feeding fire grate has been patented by Mr. Samuel Russell, of Apperton Villa, Staines, Middlesex, England. A magazine is provided from which the fuel is fed automatically into the grate as the coal is consumed.

A convenient case for holding bills, letters, etc., adapted to be placed in the pigeon holes of a desk, has been patented by Mr. H. J. Hoffman, of Neillsville, Wis. The case is constructed with an end piece to which a cover is hinged, so that, when turned upward, it rests on the end piece of the case, holding the papers in a convenient position for inspection.

A device for holding the free end of a ribbon on the roll on which it is wound has been patented by Mr. J. Mellette, of Winamac, Ind. This consists in a U-shaped wire spring, the ends of the prongs being secured in the holder, and the circular portion of the wire passes over the ribbon and prevents its becoming unwound from the wooden roll.

A simple and effective mode of fastening the end gate of farm wagons has been patented by Mr. Andrew Graham, of Clarion, Iowa. The inventor provides a rod hooked at each end which extends across the tailboard near its center. One end of the crossbar or rod is hooked into the body of the wagon, and the other end engages with a lever which is provided with a trip device for relieving the rod, which enables the end board to be readily removed.

An ingenious and amusing toy milch cow has been patented by Messrs. W. H. Mantz and Robt. Blum, of Mt. Vernon, Ill. There is a tank for holding the milk inside of the cow extending into the udder, attached to which are syringe-pump teats that give forth the milk when manipulated in the ordinary way. A rod running through the cow to her jaw is attached to the pump in such a manner that when the milking operation is in progress it moves the jaw, giving the appearance that the cow is chewing her cud.

A wire fence in which the tension of the wire is throughout the same, whether the ground be level or otherwise, is the subject of a patent granted to Mr. W. C. Gholson, of La Grange, Ga. The posts which support the wire are provided at their lower ends with lateral projections for anchoring them in the ground, while the corner posts are provided, in addition, with braces. The wires are held to the post by roller brackets, thus permitting the wires to stretch a long distance over the rollers, whereby the tension will be greater and the resisting power of the wire increased. These wires are prevented from spreading apart by cross wires, or should this not prove sufficient, wooden stays are substituted.

Business and Personal.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

---

(1) J. F. T. writes: Having noticed in a recent issue of your valuable paper that a premium had been offered by a British society for the cheapest and most durable plant and tree label, please allow me to state, though not wishing to compete for the prize, that a sheet of common sheet zinc, written on with a lead pencil, has preserved the letters quite legibly when exposed to the weather for five years. If cut slightly tapering, a few inches longer than needed, and wrapped spirally round a small tree limb, no injury will result, but it will expand as the tree grows, and remain good for many years. If the name is gone over anew with a pencil every two years, such a label is almost perpetual and cheap enough to suit any one, as they can be made for a fraction of a cent each.

(2) D. U. B. asks for a receipt for a paint for brick walls 9 inches thick, that will prevent dampness. A. A good metallic paint mixed in pure linseed oil will protect a wall from dampness as well as any paint can do it.

(3) J. H. C. asks for a simple process for making yeast for fermenting beers. A. Brewer's yeast is prepared as follows: 73 pounds unkilned malt and a handful of hops are gradually stirred in a clean tub containing 7 gallons of water of 170° Fah.; and to this 5½ gallons water of 200° are added. The tub is then covered tightly and left quiet. After some time it is cooled rapidly. This is accomplished by setting in cans filled with cold water. When the temperature of the mash has reached 70°, the tub is covered again and allowed to stand for some twelve hours longer, when 1½ gallons fresh beer yeast are to be stirred in. After another twelve hours have elapsed, pierce a hole in the layer formed by the husks of the malt and dip 3½ gallons of the liquor beneath, then stir the whole up and dip 1¾ gallons from it (husks and liquor). This is the mother leaven from which yeast can be generated all the year round by using it in the way described instead of the ordinary beer leaven. To the remainder in the tub add 5 gallons wort of 90°, and make use of it within two hours. The mother yeast also must be used the same day for fermenting another portion.

(4) E. B. M. asks for a receipt for a good gum for use on tobacco tags and labels. A. Use a paste made of good rye flour and glue to which linseed oil, varnish, and turpentine have been added in the proportion of half an ounce of each to the pound.

(5) G. O. H. writes: Under the captivating name of "Oriental Barometer," there is sold an artificial flower, stained with some chemical substance which changes its color with the varying hygrometric state of the air; turning pink or red with much moisture, and blue when it is dry. It is a rather pretty toy. What chemical is used? A. Solution of cobalt chloride is used.

(6) J. K. asks: In rolling any round substance over a level surface, what power causes said round substance to stop? A. The resistance to a rolling ball comes from the friction of the air upon its surface, the resistance or compression of the air against the front, and the compression of the point of contact with the plane over which it is rolling, which in fact is no point, but a nearly flat surface, which is smaller as the substances are harder.

(7) G. B. B. asks: 1. Can you give me a receipt for staining maple gray? It is easy to get gray veneers, but I want to stain the solid wood gray. A. Try the following: Expose a quantity of old iron, or, what is better, the borings or turnings, in any convenient vessel, and from time to time sprinkle them with muriatic acid, diluted in four times its quantity of water, till they are very thickly covered with rust; then to every 6 pounds add 1 gallon of water in which has been dissolved 2 ounces potassium carbonate; lay the wood in the copper, and cover it with this liquid; let it boil for two or three hours till well soaked, then to every gallon of liquor add a quarter of a pound of green copperas (iron sulphate) and keep the whole at a moderate temperature till the dye has sufficiently penetrated. 2. Can you tell me what is "linseed oil varnish," recommended in a recent number of your paper for applying to hard wood floors? A. To make linseed oil varnish: Boil linseed oil 60 parts, with litharge 2 parts, and white vitriol 1 part, each finely powdered until all water is evaporated. Then set by.

(8) J. J. W. writes: I am trying to make a kaleidoscope, have the glass strips incased, and the colored bits of glass in place, and get the reflection, but there is too much of it. I get the center figure, but this is reflected, and shows on the inside. I want to know how to get *one* well defined, clear cut figure in the center. I have used glass 10 and 12 inches long, 1½, 1¾, and 2 inches wide, all with same result. A. For kaleidoscopes, use plain thin polished plate, 6 inches or 7 inches long, object end 1 inch to 1½ inches wide. Black the backs with asphaltum varnish. Use two mirrors only. Make the angle exactly to suit the figure required—6 sides 60°, 8 sides 45°. Adjust the angle by sight to perfect the figure. Make the hole in the eye end very near the angle of contact. Black the tube over the open side and define the outside of the image as circular or angular by the rim of the cell. If you use a third mirror, you will multiply the number of images.

(9) F. L. M. asks for a receipt for cleaning and repolishing brass band instruments. A. For band instruments use as little abrading powder as possible. If cared for every day, a little whiting or refined chalk upon a piece of chamois is all that is necessary. If they are neglected and become oxidized, a solution of oxalic acid and water will clear the oxide by rubbing the spots with a cloth moistened with the acid.

(10) J. F. asks: How much coal is consumed in one of our largest steamships (during twenty-four hours) going from New York to Liverpool? A. About 175 tons each twenty-four hours.

(11) E. C. S. writes: I am very anxious to know if white sand can be melted when not mixed with other substances. If so, what heat is necessary? A. White sand, or silica, will melt at the welding heat of a forge. It is used by blacksmiths as a flux for welding wrought iron. It cannot be melted in a crucible and cast in shapes like iron because it is viscid or thick like molasses at any heat that can be attained in ordinary fires. The slags from furnaces run freely because of their mixture with lime, iron, and other earths from the ores and added fluxes. A crucible made of pure fire clay, such as is used in glass houses, would stand the heat required to melt pure silica, but you would find difficulty in raising sufficient heat in any ordinary furnace to more than cement it into a mass.

(12) J. W. B. asks for a recipe for staining cherry in imitation of old mahogany. A. Digest logwood chips in vinegar or acetic acid for twenty-four hours or more. When ready to use, heat the solution, then dip the wood until suitable color is obtained.

(13) E. J. A. asks how to make and use in small iron castings, cores of an eighth of an inch thickness. A. Your query is not explicit enough to admit of anything but a general answer. It depends upon the size of the cores that are an eighth of an inch thick, and also the bulk of iron that is to surround the cores. The malleable iron and brass founders find no difficulty in making small thin cores by stiffening new moulding sand with a very small quantity of flour paste or glue water. Dry the cores in an oven not hot enough to burn the paste or glue. Some use stale beer instead of the paste or glue. If the core is long and slender, a small wire inserted is good to stiffen or prevent it from breaking.

(14) W. R. asks how charcoal is used for casting fine brass and alloys. How is it prepared and how set in the moulds. Is there any periodical devoted to brass casting and similar work? A. Among brass founders charcoal is used to dust the moulds for the purpose of making the metal run smooth, pound the charcoal in a mortar to fine dust and put into a little bag of cotton cloth. Shake over the mould and blow the surplus off. For a complete work on brass moulding and casting get "Larkin's Practical Brass and Iron Founder's Guide."

(15) D. B. asks: 1. Are hollow brick walls better and stronger than solid walls? For instance: brick building—4 stories—1st floor earth; 2d story, machine shop, say 15 tons; 3d story, stove shop, say 9 tons; 4th story, light goods, say 6 tons. A. The tremor of factories is more severe upon hollow walls than upon solid walls, unless more than the quantity of material in a solid wall is put into a hollow wall. It is the weight of material in the walls that counteracts tremor and swaying. A hollow wall under any circumstance for factories should be thoroughly bonded at small intervals. 2. What is the proper diameter and thickness of metal in the columns for each flat to support the above weight? A. This cannot be answered without more data.

(16) J. J. writes: I am engaged in sheep raising, and in marking them with paint or tar the wool is injured. Could you suggest any substance that would mark and remain for a year, and then be removed without injury to the wool? A. The following is recommended as a waterproof branding ink:

Shellac	2	ounces.
Borax	2	"
Water	25	"
Gum arabic	2	"
Lampblack, sufficient.		

Boil the borax and shellac in water till they are dissolved, and withdraw from the fire. When the solution has become cold, complete 25 ounces with water, and add lampblack enough to bring the preparation to a suitable consistency. When it is to be used with a stencil, it must be made thicker than when it is applied with a brush. The above gives a black ink, for red ink substitute Venetian red for lampblack; for blue, ultramarine; and for green, a mixture of ultramarine and chrome yellow.

(17) T. G. C. asks for a cheap wash that would prevent the wet penetrating into brick walls. The bricks are very porous and paint is too expensive. The houses are always damp after rain. A. Try a thin wash of Portland or Rosendale cement, with preference for the former. It is to be applied in the same way as whitewash.

(18) A. W. M. asks for a paint or varnish suitable for kitchen walls, that will wash or can be cleaned in some easy manner. Walls not hard finished. A. Use a linseed oil paint, that is, any colored metallic oxide ground in linseed oil.

(19) H. W. B. asks: 1. If a coil is wrapped around one end of a piece of iron and a current of electricity passed through it, do not both ends of the iron become magnetic at once; and if we intended using this magnet as a source of power, would we not obtain about double the power if we utilized both poles of the iron bar instead of only one? A. You would secure a great increase of power by the use of both poles. 2. Does the fact of a secondary current being taken for use in any way, waste the primary, *i. e.*, suppose we have two batteries of equal power and the current from both of which is run through coils of the same length and resistance (one coil however is surrounded by another from which we obtain a secondary current) is the primary current in any way weakened, or do we obtain the full force of the primary plus the force of the secondary? A. The primary current is weakened by the presence of the secondary wire.

(20) O. C. W asks: How are red, blue, and black inks for rubber printing stamps made? A. Blue ink:

Indigo in fine powder	10	parts.
Gum arabic	4	"
Glycerine	4	"
Water	3	"

Dissolve the gum in water, mix it with the glycerine, and then triturate it thoroughly in a mortar with the indigo until a thoroughly homogeneous mixture is obtained. For black ink use nigrosin in less quantity and add dextrine to stiffen the mixture. 2. What will prevent the rubber from sticking to the plaster matrix? A. Use soap. 3. What temperature should the rubber be heated? A. That depends altogether upon the composition of the rubber mass. 4. What kind of oil should be used to oil the type? A. The use of oil is not advisable under any circumstances.

(21) A. H. asks: How can thick, tough Manila paper be made thoroughly waterproof in the sheet, and yet remain pliable? A. Melt in 10 pints hot water, 30 ounces glue, gelatine, or size, and 3 ounces gum arabic. In another 30 pints hot water melt 2 ounces of soap and 4 pounds alum. Mix both liquids together in one pot. This constitutes compound No. 1. In another pot heat a half a gallon benzol and 1 gallon paraffine, and melt in it 24 ounces resin; let it boil until it attains a moderate degree of consistency. To these materials, resin, oil, and copal or mastic varnish may, in some cases, be added. This is composition No. 2. First dip the article to be waterproofed into the composition No. 1, in a heated state, and then dry it. Next apply No. 2 in a cooled state with a brush or in any other convenient manner. Care should be taken to avoid igniting the benzol, as it is highly inflammable.

(22) E. L. C. writes: 1. In steaming lager beer (Pasteurizing) I find a large number of the bottles break on being immersed in the warm water at 50° F. Is there any means I can adopt to prevent the leakage? A. In order to preserve the bottles, we would suggest that they be universal in cold water and the same gradually heated until the boiling point is reached, and then slowly cooled. This if repeated has the effect of annealing the glass. 2. Also, if you would please state the usual process of Pasteurization, and the temperatures used at first and last? A. Heat to about 160° in two periods, say first to 80° and then to 160°. The bottles in which the beer is heated should be very carefully chosen, free from flaws; and as nearly as possible of uniform thickness. After the desired temperature has been attained, it should be very gradually cooled, one of the causes of breakage is the bottles coming in contact with the steam or hot air pipes used for heating, which must be avoided. A wooden framework on the bottom of the trough in which the bottles stand will best secure the result. In cooling it will be an advantage if the bottles stand on wood instead of stone or metal.

(23) E. F. F. asks for the process of the manufacture of the gelatine sheets such as are used for coloring the flame of the calcium light. A. Dissolve fine glue or isinglass in water so that the solution when cold may be consistent. Pour it hot on a plate of glass (previously warmed with steam and slightly greased) fitted in a metallic frame whose edges are just as high as the wafer should be thick. Lay on the surface a second glass plate, also hot and greased, so as to touch every point of the gelatine while resting on the edges of the frame. By its pressure the thin cake is rendered uniform. When the glass plates have cooled, the gelatine will be solid and may be removed. It can then be cut into disks by punches, etc. It can of course be colored by adding suitable coloring material, aniline colors for instance.

(24) H. D. H.—If you have a single piece to harden, such as a watch spindle bearing or escapements, or pieces that a gas jet will heat, you can mix a little soap and lampblack (soft soap if you can get it). Bind the piece with a turn of binding wire (very fine) to hold by; put a little of the soap and lampblack upon the piece to protect it from the air. Heat in a gas jet and plunge endwise in cold water. Some use a large alcohol flame to good advantage. Springs laid upon a little cage of binding wire, so as not to interfere with the uniformity of heating, may be heated by an alcohol flame. Lay a thin piece of charcoal on the top of the spring to get an even heat. Drop the spring into the water flat, so that all parts will enter the water at the same instant.

(25) F. T. H. writes: I am making sal-ammoniac batteries and have a quantity of ground coal carbon (obtained from the gas works), of which I desire to make carbon plates. 1. With what shall I mix the carbon? A. Ordinary gas carbon is generally used and sawed to suitable sizes, or else press together in an iron mould a mixture of coal dust and powdered bituminous coal and then heating in a furnace. A mass is thus obtained, which by being soaked in sugar-sirup, or molasses and calcined again acquires great compactness and high conducting power. 2. What material is best for the mould? A. Iron mould. 3. Must the mixture be carbonized at an intense or at a moderate heat? A. Red heat. 4. If there is any danger of the carbon sticking to the mould, please let me know how to prevent its doing so. A. They are not apt to stick. 5. Please give me a good recipe for the composition of which printers' rollers are made. A. Use glue and molasses in proportions varying from 8 pounds of glue in summer to 4 in winter for each gallon of molasses.

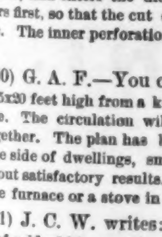
(26) H. M. P.—Your object glass of 31 inches focus will probably need not more than 2 eyepieces which should be of the Huyghenian form, consisting of a plano-convex lens for a field glass, and also a plano-convex lens of a lesser diameter and focal length for the eye lens. For the best form the focal length of field lens should be three times the focal length of the eye lens. They should be placed at one-half the distance of the sum of their focal lengths apart. You can purchase the eyepieces already made up at any optical establishment and in Boston at Stodder's, 131 Devonshire Street; ask for microscope eyepieces. An A eyepiece will give you a power of 12. A B eyepiece will give you 20, and a C eyepiece will give a power of 30. If you wish to try higher power, a D will equal 50, and still further an E will give a power of about 90, which will probably be higher than your object glass will stand, unless it be an extra fine one in definition.

(27) Scribe.—The finest common black ink is prepared according to the old receipts from tannin or extract of galls and a protosalt of iron, in connection with gum—thus:

Blue nutgalls, powdered	7 pounds.
Copperas, iron sulphate	1 pound.
Mucilage of gum arabic	q. s.
Water	q. s.
Oil of cloves	a few drops.

The tannin of the galls having been extracted by boiling with a small quantity of the water, and the liquid extract allowed to settle and cool, it is then mixed with the iron salt previously dissolved in a sufficient quantity of cold water, and the mixture agitated with gum water. The quantity of gum used is usually about one-third the weight of the galls employed; the quantity of water about one gallon to the pound of galls. The ink is rendered darker when first written with by the addition of a small quantity of sal ammoniac, one ounce or so to the gallon. Logwood extract is also sometimes employed for a similar purpose. For full color, body, and fluidity we generally prefer one of the aniline preparations. In these aniline black is the basis of the color. In preparing the ink the darkest shade of soluble nigrosine is usually chosen. It is first made into a thick paste, by grinding or triturating it in a mortar with a small quantity of hot water. This paste is then mixed with a suitable quantity of warm water (not too much) and strained through a silk bag, when it is ready for use. It has, when reduced with considerable water, a bluish color; this may be corrected by very slightly acidifying it with sulphuric acid and adding a small quantity of ordinary gall iron ink or a strong aqueous decoction of alizarine.

(28) A. A. L.—To make a filter with a wine barrel, procure a piece of fine brass wire cloth of a size sufficient to make a partition across the barrel. Support this wire cloth with a coarser wire cloth under it and also a light frame of oak, to keep the wire cloth from sagging. Fill in upon the wire cloth about 3 inches in depth of clear, sharp sand, then 2 inches of charcoal broken finely, but no dust. Then on the charcoal 4 inches of clear, sharp sand. Fill up the barrel with water, and draw from the bottom.



(29) W. S.—Watch hands are punched. The die block is divided lengthwise of the hand and held together by a collar and set screws. The punch is solid, and enters the die on a shear, *i. e.*, one end enters first, so that the cut does not all take place at once. The inner perforations are made with a separate die.

(30) G. A. F.—You cannot heat a building 15x15x20 feet high from a kitchen boiler at 50 feet distance. The circulation will be sluggish or wanting altogether. The plan has been tried for plant rooms at the side of dwellings, smaller than your building, without satisfactory results. We recommend a small house furnace or a stove in a small chamber.

(31) J. C. W. writes: I have a small quantity of gold which contains a large percentage of copper. Could you give me a method for separating the gold from the copper? A. Treat the alloy with nitric acid; this agent will dissolve out the copper; or else dissolve the entire mass in aqua regia, and precipitate the gold with ferrous sulphate.

(32) C. C. C. asks in regard to the process of engraving on metals, by the use of acids, with the parts which are not to be acted upon protected by wax: 1. What metal will work most quickly, that is hard enough, or that can afterward be made hard enough for printing purposes? A. Zinc, in rolled plates. 2. What acid will work most quickly? A. Dilute sulphuric acid. 3. How long will it take to cut the metal to a depth of one-sixteenth of an inch? A. About half an hour. 4. What substance may be used instead of wax? A. Asphaltum varnish.

(33) W. S. writes: Please give me recipe for good lubricant in which to soak hemp or flax packing to be used for steam or water. A. We know of nothing better than clean kidney tallow, tried out with steam or over a fire. Dip the hemp or flax packing in the tallow while warm, and draw it through the hand to clear it of excess of tallow.

(34) C. H.—Artificial honey consists of sirup or glucose flavored slightly by phosphites and sometimes a little pure honey is added. In California one part of honey is mixed with one part of glucose. For the comb various mixtures of waxes are used.

(35) F. S. asks: What is true magnetic iron? Is it valuable? Does it indicate the presence of precious metals? A. Magnetic iron is loadstone or magnetite. It is the most valuable iron ore that is mined. Its value depends upon the percentages of sulphur and phosphorus that it contains.

(36) D. S.—The simplest way is to stretch a string so as to touch the style of the sun dial at its edge and in line with the north star; fix the style parallel with the string with its base level, then drop a plumb line from the string beyond the style, then observe when the shadow of the polar string touches the plumb line; mark the shadow of the style upon the base of the dial. See article in *Notes and Queries* September 30, 1882, No. 3, "How to Construct a Sun Dial."

(37) R. P. V. asks: 1. How are letters and figures put on satin or silk with bronze without printing them? A. Letters upon satin or silk are printed, stenciled, or painted, and then bronzed. 2. What elements have been discovered since caesium? A. Gallium, norwegium, thallium, davyium, beryllium, neptunium, ilmenium, and several others. 3. Why is it that Haswell's "Melting Points of Metals," differs from other works? A. "Haswell's Melting Points of Metals," is gathered from various authors and experimenters. They seldom agree, from the difficulty in managing high temperature tests, and uncertainty of the value in expansion in pyrometers.

(38) E. C. L.—Castor oil, 5 parts, thinned with refined petroleum, 1 part, is a good lubricating oil for bicycles or any other fine machinery. Good, sweet, cold pressed lard oil mixed with petroleum in the same proportion as above is also excellent.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

L. W.—The sample is a rock containing nodules of iron pyrites, probably carrying arsenic, and called mineralogically arsenopyrite.—F. C. Y.—The sample sent is quartz rock without any apparent signs of gold or silver. An assay would show how much, if any, of the precious metals it contained.

COMMUNICATIONS RECEIVED.

On Flying Machines. By G. B.
On New Use for Gas Mains. By G. A. S.
On Crystal Rock. By W. C. B.
On the Keely Motor. By W. N.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

May 1, 1883,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid, manufacture of cinnamic, C. Rudolph ... 276,888
Adding machine, P. Neary ... 276,806
Advertising windmill, J. E. & G. S. Spencer ... 276,640
Annunciator, telephonic, G. L. Weaver ... 276,739
Atomizer, W. A. Turner ... 276,940
Awning for hop pickers, J. Engle, Jr. ... 276,791
Baling press, J. McIver ... 276,615
Bar. See Harvester cutter bar. Rail joint splice bar.
Bark conveyer, O. A. Lane ... 276,605
Bed bottom, spring, F. Spoehr ... 276,918
Bed or lounge, folding, O. Stechhan ... 276,729
Bed slats, device for fastening springs to, Ames & Frost ... 276,548
Bed spring, B. H. Hickok ... 276,818
Bed, etc., spring, S. F. Seely ... 276,901
Bedstead, folding, J. M. Montgomery, Jr. ... 276,859
Beer cooling apparatus, W. Nussbeck ... 276,870
Beer, process of and apparatus for brewing, J. J. Metzler ... 276,617
Belt fastening, M. A. Nye ... 276,620
Berth, self-leveling, L. D. Newell ... 276,867
Berth, self-leveling, J. H. Porter ... 276,874
Bicycle lock, Kenfield & Stilwell ... 276,600
Bird cage bathing attachment, S. P. Park ... 276,871
Blast furnaces, hot blast stove for, H. W. Ellicott 276,790
Block. See Pulley block.
Boiler. See Tubular boiler.
Boiler furnace grate, moving, D. C. Hill ... 276,691
Boiler furnace, steam, J. G. Sextro ... 276,908
Boiler or other furnace, steam, C. Gearing ... 276,576
Book backing machine, roller, E. P. Donnell ... 276,787
Book, blank, A. E. Kipp ... 276,601
Broom-stick, Durell & Goldie ... 276,789
Boot and shoe sole cutting machine, H. C. Pease. 276,979
Boot or shoe heel stiffener, E. Andrews ... 276,550
Boot or shoe heel stiffeners, forming, C. Rochette 276,717
Besom stretcher and ironing board, A. C. Gibson. 276,802
Bottle stopper, F. F. Jewett ... 276,822
Bottle stopper and draught nozzle, P. Henrichs. 276,816
Bottle stopper, mustard, J. Gulden ... 276,683
Box. See Folding box. Journal box.
Box nailing machine, Smith & Doig ... 276,726
Bracket. See Dental bracket. Siding bracket.
Brake. See Car brake. Locomotive and train brake. Wagon brake.
Brick and tile machine, J. C. Anderson ... 276,549
Brick machine, dry pressing, Morrison & Willett. 276,861
Buckle frames, making, H. E. Fowler ... 276,797
Bung and bush, W. Seng ... 276,902
Butter package, W. H. Roberts ... 276,882
Button fastener, F. A. Smith, Jr. ... 276,638
Button fastener, J. F. Thayer ... 276,645
Button fly-lap and staying piece, combined, D. W. Thompson ... 276,936
Button or stud, T. W. F. Smitten ... 276,917
Cable stopper, O. Lynch ... 276,841
Calendar, L. M. Switzler ... 276,643
Can. See Milk can.
Candle, G. H. Kirk ... 276,602
Cape and hood, combined, M. Seiler ... 276,720
Car brake, D. Torrey ... 276,931 to 276,938
Car brake, automatic, D. Torrey ... 276,930
Car brakes, automatic take-up for, D. Torrey ... 276,929
Car coupling, H. Gross ... 276,681
Car coupling, D. Kunkel, Sr. ... 276,977
Car door fastening, W. P. Jackson ... 276,593
Car door, freight, B. F. Teal ... 276,644
Car label holder, freight, A. D. Penfold ... 276,980
Car signal, R. P. Garsed ... 276,801
Car, stock, B. P. Joiner ... 276,595
Car wheel, W. W. Snow ... 276,727
Card grinding machine, B. S. Roy ... 276,884
Carpet beating machine, H. W. Bates ... 276,656
Carriage, child's, H. F. Brooks ... 276,955
Carriage, folding baby, F. Meyer ... 276,853
Carrier. See Game carrier. Hay carrier.
Case. See Paper card case. Pencil case.
Centrifugal machine, C. Von Bechtolsheim ... 276,965
Chair. See Opera chair. Rocking, reclining, and easy chair.
Chair and bed, combined, S. A. D. Clark ... 276,774
Chamfering machine, T. Tobin ... 276,927
Chinoline, preparation of oxyhydro-methyl, O. Fischer ... 276,796
Chopper. See Cotton chopper.
Churn, H. Kean ... 276,598
Churn, V. Stirewalt ... 276,922
Churn power, J. M. Furlong ... 276,780
Cigar tip cutter, F. Flad ... 276,964
Clasp. See Corset clasp.
Clothespins, machine for making wire, A. E. Francis ... 276,575
Clover hullers, recleaning attachment for, M. O. Meacham ... 276,851
Clutch mechanism, D. B. Hartley ... 276,688
Cock, gauge, J. Lee ... 276,836
Cock, steam, W. R. Middleton ... 276,618
Coffee and other beverages, method of and apparatus for making, J. C. Grant ... 276,579
Comb. See Currycomb.
Compressing dry and plastic materials, machine for, C. Killgore ... 276,828
Collar, horse, S. Gissinger ... 276,577
Cooler. See Milk cooler.
Cops, apparatus for rewinding yarn from broken or damaged, R. L. Carr ... 276,668
Corkscrew, M. Green ... 276,804
Corn, device for hanging seed, A. Belding ... 276,755
Corset clasp, A. Ottenheimer ... 276,978
Cotton chopper, J. H. Brown ... 276,557
Cotton chopper, Kemp & Mock ... 276,599
Coupling. See Car coupling. Thill coupling.
Cover handle, vessel, J. Chaumont ... 276,772
Crate or box, folding shipping, J. McIntyre ... 276,850
Crib, chair, and commode, combined, J. B. Rohrer ... 276,633
Cultivator, H. H. Sater ... 276,718
Cultivator, M. L. Utter ... 276,984
Cultivator, wheel, W. E. Butler ... 276,766
Currycomb, A. Hermundson ... 276,817
Currycomb, J. D. & W. C. Lawrence ... 276,696
Cutter. See Cigar tip cutter.
Cutter head for boring machines, W. Bramwell. 276,760
Damper regulator for steam boilers, V. H. Hallock ... 276,810
Dental bracket, F. Slater ... 276,637
Dental drill, E. T. Starr ... 276,921
Detector. See Time detector.
Digging machine, T. C. Darby ... 276,783
Door lock, A. Montant ... 276,858
Door lock, sliding, A. B. Walters ... 276,941
Door opener, M. L. Powell ... 276,626
Draught equalizer, W. Lewis ... 276,611
Drill. See Dental drill.
Eaves trough hanger, J. P. Abbott ... 276,654
Egg shelf, H. M. Lindenthal ... 276,612
Electric call, Currier & Rice ... 276,960
Electric machines, armature for dynamo, L. Daft 276,568
Electric way, E. M. Bentley ... 276,953, 276,954
Electric way, Bentley & Knight ... 276,757
Electric way, Knight & Bentley ... 276,829
Electrical conductor, T. S. Reed ... 276,880
Electrical purposes, covering wire for, J. J. C. Smith ... 276,725
Electrical purposes, machine for covering wire for, J. J. C. Smith ... 276,724
Electrotype rollers for imitating leather, etc., manufacturing, N. L. Cocheu ... 276,777
Elevator. See Grain elevator. Mail elevator.
Elevator, L. Daso ... 276,784, 276,785
Elevator platforms, safety apparatus for, V. W. Mason ... 276,849
Engine. See Gas engine. Steam engine.
Explosive compounds, manufacture of, A. J. Lanfrey ... 276,833
Extractor. See Spike extractor.
Fare register and alarm, W. J. Richardson ... 276,713
Fastening for bags, pocketbooks, etc., J. W. Meaker ... 276,852
Fence, J. Gier ... 276,679
Fence, barbed, W. S. Roberts ... 276,883
Fermenting and clarifying beer, wine, etc., apparatus for, J. Sargent ... 276,635
Fibers, etc., machine for obtaining, S. P. Smith ... 276,915
File cutting machine, W. McClellan ... 276,698
Filter, J. Howes ... 276,820
Firearm, breech-loading, W. B. Hall ... 276,808
Firearms, combined stock and case for, J. Jett ... 276,593
Fire escape, W. F. Clerk ... 276,699
Fire escape, G. Heidel ... 276,815
Fire escape, A. C. Hitchcock ... 276,989
Fire escape, G. Hofmann, Jr., & A. D. Hoffman ... 276,585
Fire escape, G. Kelly ... 276,973
Fire escape, Lindsey & Raleigh ... 276,610
Fire escape, A. P. Sturtevant ... 276,730
Fire escape, H. B. Walbridge ... 276,736
Fire escape ladder, J. Riley ... 276,715
Fire mask, C. McIntosh ... 276,699
Fish meal, manufacturing, Nichols & Thomson ... 276,868
Floor mat, S. Toffler ... 276,983
Flower stand, E. J. Bonett *et al.* ... 276,669
Folding box, S. J. Everett ... 276,676
Frame. See Picture frame.
Friezing machine, F. C. Miller ... 276,855
Fruit jar cover fastener, W. Cochrane ... 276,670
Furnace. See Boiler furnace. Boiler or other furnace. Ore desulphurizing furnace.
Furnace grate, J. A. Price ... 276,876
Game carrier, A. White ... 276,945
Gas engine, C. W. Baldwin ... 276,747 to 276,751
Gas, process of and apparatus for manufacturing, J. H. Collins, Jr., & Granger ... 276,562
Gate, J. H. Caldwell ... 276,769
Gearing lubricator, H. Winter ... 276,987
Generator. See Steam generator.
Glass, chinaware, etc., decorating, H. Schulze-Berge ... 276,896
Glassware, etching, H. Schulze-Berge ... 276,893 to 276,895
Glassware, ornamenting, H. Schulze-Berge ... 276,897
Glove fastening, W. S. Richardson ... 276,714
Glove finishing apparatus, A. C. Calderwood ... 276,768
Glue, coloring, G. J. Lesser ... 276,609
Glue size, manufacture of, G. J. Lesser ... 276,608
Glycerine from the waste soap-liquor of soap manufacture, extracting, J. P. Battershall ... 276,551
Grading machine, H. T. Hays ... 276,583
Grain elevator, conveyer and cleaner, combined pneumatic, M. Randolph ... 276,879
Grain scourer, Hanson & Leas ... 276,585
Grain shovel, M. W. Hanley ... 276,684
Grapple, R. L. Betts ... 276,658
Grate, G. B. Mershon ... 276,616
Grinding mill, G. W. Doolittle ... 276,570
Gun wiper, extension, J. S. Birch ... 276,660
Hame, C. E. Smith ... 276,913
Hame fastener, J. R. Finly ... 276,963
Handle. See Cover handle.
Hanger. See Eaves trough hanger.
Harness pad press, F. M. White ... 276,946
Harvester, D. R. Brown ... 276,764
Harvester, J. P. Manny ... 276,847
Harvester and truck, combined, J. F. Steward ... 276,642
Harvester cutter bar, J. E. Lewis ... 276,838
Harvesters, transporting frame and wheel for, A. Gump ... 276,581
Harvesting machine, cotton, W. L. Black ... 276,661
Hat sizing machine, A. Pelisse ... 276,708
Hat, sunshade, S. B. Bartine ... 276,753
Hatchway guard, automatic elevator, Byers & Taylor ... 276,767
Hay carrier, F. H. Bolte ... 276,556
Hay carrier, L. Y. Myers ... 276,864
Hay knife, S. J. Baker ... 276,951
Hay press, J. Wadleigh ... 276,649
Hay rake, L. T. Hatfield ... 276,689
Hay ricking device, R. O. Davis ... 276,673
Headlight, locomotive, A. Harris ... 276,814
Heating apparatus, electrical, Lieberman & Robb. 276,840
Heel lifts, machine for nailing, Q. A. Townes ... 276,648
Hinge for sliding and rolling gates, J. S. Wood ... 276,949
Hinge, spring, C. B. Clark ... 276,958
Holder. See Car label holder. Pencil or crayon holder. Pillow sham holder. Rein holder. Trace holder.
Hook. See Lacing hook. Snap hook.
Horseshoe, E. S. Thurber ... 276,647
Horseshoe calk, detachable, J. Joadwine ... 276,694
Hub, vehicle, E. P. Newman ... 276,706
Indicator. See School indicator.
Indigo, manufacture of metamethyl, C. Rudolph. 276,890
Indigo, material for the manufacture of metamethyl, C. Rudolph ... 276,889
Inhaler, C. Hilbert ... 276,968
Injector, L. Schutte ... 276,898
Inking roller, sectional ... 276,825
Insect destroyer, Loomis & Dupont ... 276,613
Insect exterminating pad, T. Manahan ... 276,844
Insulating electrical conductors, J. G. Sanderson. 276,891
Insulating conductors and a new compound suitable to be used for this and other purposes, W. Smith ... 276,916
Insulator for telegraph wires, J. S. Lewis ... 276,839
Iron. See Wagon seat iron.
Jack. See Lifting jack. Wagon jack.
Joint. See Railway rail joint.
Journal box, S. Benson ... 276,756
Key ring, G. W. Jopson ... 276,826
Knife. See Hay knife. Pocket knife.
Knob attachment, R. S. Watson ... 276,942
Lacing hook for gloves, W. F. Foster ... 276,573
Lamp, electric arc, L. Daft ... 276,565 to 276,567
Lamp, incandescent electric, P. Diehl ... 276,571
Lamp, voltaic arc, O. A. Moses ... 276,703 to 276,705
Lamps, glass bulb or globe for incandescent electric, A. Swan ... 276,924
Lantern, ship, N. Tufts ... 276,733
Lap forming machine, J. T. Lemaire ... 276,606
Last, G. M. Wells ... 276,651
Latch, locking, F. Palmer ... 276,623
Leather gauging and marking machine, C. Dancel 276,782
Leggin, S. L. Waldman ... 276,737
Lifting jack, J. O. Joyce ... 276,827
Light. See Headlight. Voltaic arc light.
Lock. See Bicycle lock. Door lock. Nut lock. Seal lock.
Locomotive and train brake, D. Torrey ... 276,928
Locomotive cab window, J. Shields ... 276,907
Locomotive, tramway, W. Wilkinson ... 276,948
Loom temple, J. H. Crowley ... 276,959
Lubricating axles, composition for, H. W. Reddan ... 276,711
Lubricating eccentric, B. S. Roy ... 276,885
Lubricator. See Gearing lubricator.
Mail elevator, automatic, J. W. Paine ... 276,707
Mat. See Floor mat. Oil press mat.
Measure, fluid, M. Wolf ... 276,652
Measuring device for shot pouches, powder flasks, etc., H. T. Hazard ... 276,690
Measuring machine, cloth, C. B. Shaw ... 276,722
Medicinal compound, E. H. Lawrence ... 276,835
Metal rods, reheating and reducing, H. H. Andrew ... 276,743
Milk can, D. C. Cripe ... 276,780
Milk cooler, J. W. Irish ... 276,590
Mill. See Grinding mill. Rolling mill. Stamp mill. Windmill.
Mill machinery, drop lift step for, Kohnle & Hamilton ... 276,603
Mixing flour, etc., machine for, P. Thorpe ... 276,646
Moulds and cores, compound for coating dry sand, J. F. Richards ... 276,628
Monthly protector, G. Campbell ... 276,770
Motion, apparatus for transmitting differential rotary, G. F. Clemons ... 276,776
Motive power, hand, W. H. S. Burgoyn ... 276,665
Musical instruments, transposing key board for, W. J. Guernsey ... 276,682
Nailing machine feeder, Smith & Doig ... 276,639
Numbering machine, automatic, C. L. Ware ... 276,986
Nut lock, J. F. Penrod ... 276,872
Oil cake trimming machine, J. T. Harbine ... 276,811
Oilcloth, manufacture of, A. F. Buchanan ... 276,765
Oil from resinous wood, method of and apparatus for the manufacture of, L. Pradon ... 276,981
Oil press mat, Mann & Schumacher ... 276,846
Opera chair, W. H. H. Knight ... 276,830
Optometer, A. A. Trowbridge ... 276,732
Ore concentrator, A. D. Clarke ... 276,772
Ore concentrator, W. S. Ward ... 276,738
Ore desulphurizing furnace, A. T. Schuessler ... 276,636
Ore separator, dry, P. W. Reardon ... 276,710
Organ, reed, W. E. Leighton ... 276,837
Pad. See Insect exterminating pad.
Paddle wheel, feathering, D. J. Blaster ... 276,663
Painter's adjustable horse or jack, carriage, B. Miller ... 276,854

Paper bag machine, C. F. Annan.......... 276,744
Paper card case, C. De Quillfeldt 276,962
Paper hanging machine and rack, H. Staib.......... 276,728
Paper pocketbook, C. De Quillfeldt.......... 276,961
Paper, wood pulp, etc., machinery or apparatus to be used in the manufacture of, Wrigley & Robertson.......... 276,989
Pen, fountain, F. Holland.......... 276,692
Pencil case, lead, W. E. Gard.......... 276,840
Pencil or crayon holder, J. S. Birch.......... 276,650
Pencil or crayon holder, F. Hardtmuth.......... 276,812
Petroleum, apparatus for vaporizing and burning, D. M. Graham.......... 276,578
Photographic plates, apparatus for washing, H. C. Price.......... 276,875
Picture frame, P. Parrett.......... 276,624
Pillow, bolster, or mattress, A Weigell.......... 276,650
Pillow sham holder, W. G. Foster.......... 276,574
Pin. See Safety pin.
Pipes, manufacture of coiled metallic, A. D. Brock.......... 276,763
Planter and fertilizer distributer, seed, W Bradford.......... 276,759
Planter, corn, R. H. Avery.......... 276,745
Planter, corn, J. E. Bering (r).......... 10,320
Planter, corn, A. N. Norris.......... 276,869
Planter, corn, L. Scofield.......... 276,719
Planter, cotton seed, L. M. Alexander.......... 276,742
Plastic and elastic composition for forming elastic rolls, pads, etc., G. J. Lesser.......... 276,607
Plastic cement mixture, R. H. Martin.......... 276,697
Plow, convertible, W. H. Detter.......... 276,674, 276,675
Pocket-knife for cutting tobacco, O. S. Harmon.. 276,813
Post driver, H. E. Fairman.......... 276,677
Pot. See Tea or coffee pot.
Powder and nitro-glycerine, apparatus for thawing giant, Murray & Gibbs.......... 276,862, 276,863
Power. See Churn power. Motive power.
Press. See Baling press. Harness pad press. Hay press. Printing press. Tobacco press.
Printing endless paper, machine for, E. Abadie.. 276,547
Printing machine sheet delivery apparatus, L. C. Crowell.......... 276,672
Printing press folder, C. Kahler.......... 276,972
Printing press, hand stamp, T. B. Cosley.......... 276,779
Printing press movement, C. F. Owen.......... 276,621
Printing press, plate, J. S. Ives.......... 276,591
Protector. See Sole protector.
Pulley block and tackle, A. M. Clark.......... 276,561
Pulley covering, W. W. Campbell.......... 276,559
Pump, P. A. Myers.......... 276,865
Pump bucket, J. La Tourette.......... 276,695
Pump, double action, G. B. McCoy.......... 276,614
Pump, rotary steam, J. Moffet.......... 276,857
Pump valve, W. H. Guild.......... 276,805
Quilting machine, A. Beck.......... 276,657
Rail joint splice bar, J. S. Seaman.......... 276,900
Railway, bridging, etc., elevated, L. T. Pyott.......... 276,878
Railway, electric, L. Daft.......... 276,569
Railway rail joint, J. A. Emo.......... 276,792
Railway rails, machinery for and method of manufacturing steel, J. Reese.......... 276,712
Railway safety appliance, A. G. Cummings.......... 276,564
Railway signal, electric, A. W. Hall.......... 276,807
Railway switch, T. Breen.......... 276,762
Railway switch, A. T. Fay.......... 276,794
Railway switch safety plate, Black & English.......... 276,554
Railway switch stand, revolving, Beard & Hinckley.......... 276,552
Rake. See Hay rake.
Refrigerator, J. A. Baldwin.......... 276,752
Refrigerator car, S. K. Bayley.......... 276,952
Refrigerator, marine, S. W. Johnson.......... 276,824
Register. See Fare register.
Regulator. See Damper regulator.
Rein holder, Baldwin & Migasi.......... 276,655
Ring. See Key ring.
Rocking, reclining, and easy chair, D. B. Hartley.. 276,687
Roller. See Inking roller.
Rolling mill, J. J. Roberts.......... 276,629
Roofing fabric, machine for making, H. M. Miner 276,856
Saccharine or other substances, refining, purifying, or clarifying, D. MacEachran.......... 276,843
Safety pin, J. Jenkins.......... 276,971
Sash weight, G. B. Smith.......... 276,913
Sash, window, A. Rudolph.......... 276,886, 276,887
Saw setting, swaging, and sharpening machine, J. C. Stevens.......... 276,641
Scarf, C. W. Manley.......... 276,845
Scale, postal, J. F. Miller.......... 276,701
Scale, weighing, F. Huebner.......... 276,693
School indicator, G. Hogan.......... 276,819
Scourer. See Grain scourer.
Screening machine, G. Kuffenberger.......... 276,596
Screws, machine for threading the points of ing, H. E. Coy.......... 276,671
Seal lock, Cannon & Ward.......... 276,666
Secondary battery plate, C. H. Koyl.......... 276,974
Separator. See Ore separator.
Sewing machine, H. Charmbury.......... 276,560
Sewing machine, W. C. French.......... 276,798
Sewing machine, T. A. Macaulay.......... 276,842
Sewing machine, Wuterich & Sheffield.......... 276,653
Sewing machine buttonhole attachment, Randall & Sims.......... 276,709
Sewing machine shuttle, J. Tripp.......... 276,731
Sewing machine trimming attachment, G. M. Morris.......... 276,860
Shaft casing, W. F. Hutchinson.......... 276,589
Shears for descaming cloth and for other purposes, F. Basch.......... 276,754
Sheet metal shearing machine, G. H. Perkins.......... 276,625
Shirt, W. L. Ball.......... 276,809
Shovel. See Grain shovel.
Shutter and fastening therefor, J. Cooper.......... 276,563
Siding bracket, S. Woodard.......... 276,950
Sign, J. Brown, Jr.......... 276,558
Signal. See Car signal. Railway signal.
Skid, W. C. Harley.......... 276,685
Skins, apparatus for removing the water-hair from seal and other, J. W. Sutton.......... 276,928
Smoke and cinder conductor, Brown & Smith.... 276,664
Smokestack, J. Ritchie.......... 276,716
Smut machine, P. V. Hennick.......... 276,584
Snap hook, J. Gibbons.......... 276,965
Soda, manufacture of bicarbonate of, E. Carey et al.......... 276,990
Soldering tin cans, machine for, J. J. Johnston... 276,823
Sole protector, W. Gordon.......... 276,803
Spike extractor, A. P. Prout.......... 276,877
Spring. See Bed spring. Vehicle spring.
Spring bending machine, J. Fowler.......... 276,678
Sprocket for rope and similar belts, J. Mills.......... 276,619
Spur, A. Buermann (r).......... 10,321
Stamp mill, F. W. Hall.......... 276,582
Stand. See Flower stand. Railway switch stand.
Starch, J. Günther.......... 276,806
Steam and heating air, apparatus for reheating exhaust, J. Hussey.......... 276,588
Steam boiler cleaning apparatus, T. C. Parves... 276,627
Steam engine, Jackson & White.......... 276,970
Steam engine crank shaft, L. Skinner.......... 276,910

Steam generator, J. W. Van Dyke.......... 276,735
Stocking blanks, cutting, M. Landenberger, Jr.... 276,822
Stopper. See Bottle stopper. Cable stopper.
Store, J. A. Houston.......... 276,587
Stove, oil, F. Sloan.......... 276,911
Stovepipe thimble and flue stopper, F. J. Karleskind.......... 276,597
Stud shield, shirt, D. W. Wilkins.......... 276,741
Suspender end, M. Silberstein.......... 276,909
Suspenders, W. A. Laverty.......... 276,834
Switch. See Railway switch.
Tan vat, G. Ruemelin.......... 276,634
Tea or coffee pot, K. Krippendorf.......... 276,976
Telephone call, individual, J. A. Lakin.......... 276,604
Telephone, electric, J. H. Robertson.......... 276,630, 276,631
Telephone receiver, G. E. Shaw.......... 276,723
Telephone transmitter, electric, J. H. Robertson. 276,632
Thill coupling, J. Groh.......... 276,580
Thrashing and cleaning machines, wind gauge for, J. E. Curry.......... 276,781
Time detector, watchman's, H. J. Wenzel.......... 276,740
Time piece, F. Schuetz.......... 276,892
Tire setter, J. P. Weller.......... 276,944
Tire, vehicle wheel, J. P. Weller.......... 276,943
Tobacco press, plug, W. T. Green.......... 276,680
Tongs, W. H. Evans.......... 276,572
Tool, combination, Erdman & Phillips.......... 276,793
Tooth, artificial, E. T. Starr.......... 276,920
Toy, E. Holden.......... 276,586
Toy trundle or hoop, J. F. Babret.......... 276,746
Trace holder and detacher, W. Standing.......... 276,919
Trains and signaling, automatically stopping, Shaffer & White.......... 276,905
Trains, signaling, etc., apparatus for stopping, W. C. Shaffer.......... 276,904
Trimming and burnishing machine, C. H. Swan.. 276,925
Truck for moving harvesters, A. Turner.......... 276,734
Tubular boiler, sectional, G. T. Pillings.......... 276,873
Tug and trace adjuster, hame, E. J. Blood.......... 276,555
Type composing machinery, F. Wicks.......... 276,947
Umbrella fixture, R. Dugan.......... 276,789
Valve, balanced slide, G. Selden.......... 276,721
Valve gear, steam engine, Clark & Blatch.......... 276,773
Vat. See Tan vat.
Vehicle drop perch, J. Herbrand.......... 276,967
Vehicle spring, McIntyre & Parsons.......... 276,700
Vehicle, spring, D. P. Sharp.......... 276,906
Vehicle top, D. Bullock.......... 276,957
Vehicle tops, hood for, C. T. Shreve.......... 276,908
Vehicle wheel, Scott & Frenier.......... 276,899
Velocipede, T. A. Davies.......... 276,786
Vise, J. A. Painter.......... 276,622
Voltaic arc light, O. A. Moses.......... 276,702
Wagon body, G. M. Hull.......... 276,821
Wagon brake, J. L. Harrison.......... 276,686
Wagon, cotton picker's, C. P. Collins.......... 276,778
Wagon gearing, plow attachment for, W. H. Kremser.......... 276,975
Wagon jack, W. C. Campbell.......... 276,771
Wagon jack, I. M. Johnson.......... 276,594
Wagon seat iron, Bewley & Mack.......... 276,553
Warping machine, R. L. Carr.......... 276,667
Washers, machine for making, J. P. Mason.......... 276,848
Washing machine, G. D. Ferris.......... 276,795
Wheel. See Paddle wheel. Vehicle wheel.
Winding yarn or thread, machine for, J. & T. A. Boyd.......... 276,758
Windlass, Bucklin & Knowlton.......... 276,956
Windlass, power, Winter & Manton.......... 276,988
Windmill, W. N. Trumble.......... 276,939
Windmill and derrick, I. W. Lamb.......... 276,831
Window, incidence, F. Bredehorst.......... 276,761
Wire coating apparatus, L. L. Smith.......... 276,914
Wire seat, woven, H. Roberts.......... 276,881
Wires, roll for flattening the ends of terminal, A. Swan.......... 276,982

DESIGNS.

Card grinding machine, B. S. Roy.......... 13,888
Carpet, H. Horan.......... 13,880 to 13,883
Carpet, E. Poole.......... 13,887
Chain, watch, W. C. Edge.......... 13,875
Curtain and upholstery fabric, H. Langer.... 13,884, 13,885
Necktie fastener, P. M. Melick.......... 13,886
Sewing machines, ornamentation of, W. Haehnel, 13,876 to 13,879

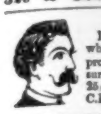
TRADE MARKS.

Accordions, F. O. Weidlich.......... 10,234
Baking powder, B. S. Gilbert & Co.......... 10,224
Balm drops, G. C. Keep.......... 10,229
Cocks, gauge, J. Regester & Sons.......... 10,251
Cure for the opium habit, Erwin, Gayden & Yongue.......... 10,250
Fencing, barbed wire, Thorn Wire Hedge Company.......... 10,233
Fertilizers, Patapsco Guano Company.......... 10,230, 10,231
Forgings and articles made therefrom, drop, Williams & Diamond.......... 10,235
Horse powers, M. Harder.......... 10,225
Lace goods, A. G. Jennings & Sons.......... 10,238
Lubricating compound, Bliven & Carrington.......... 10,223
Nets and lace goods, A. G. Jennings & Sons.. 10,239, 10,240
Nets and other reticulated fabrics, hair, A. G. Jennings & Sons.......... 10,241
Oil, cod-liver, T. P. Hogg.......... 10,228
Oil, refined petroleum, Chester Oil Company.......... 10,236
Paints and oils, Mound City Paint and Color Company.......... 10,243
Sash balances, T. Morton.......... 10,246
Sashes, scarfs, and trimmings, J. N. Stearns & Co. 10,232
Silk goods, dress, Shaen & Fithian.......... 10,247
Steam boiler scale solvents, H. J. Mark.......... 10,242
Steam boilers, composition for removing and preventing incrustation in, Hann & Co.......... 10,237
Steam boilers, compound for preventing the incrustation of, Hoffman & Ransom.......... 10,227
Steam engines, Straight Line Engine Company.... 10,248
Thrashers and separators, M. Harder.......... 10,226
Tobacco, A. Tinsley Tobacco Manufacturing Company.......... 10,249
Whisky, F. E. Kelly.......... 10,244
Whisky, Meyer Brothers & Co.......... 10,245

A printed copy of the specification and drawing of any patent in the foregoing list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 261 Broadway, New York. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, at a cost of $40 each. For full instructions address Munn & Co., 261 Broadway, New York. Other foreign patents may also be obtained.

$5,000 Accident Insurance. $25 Weekly Indemnity. Membership Fee, $4. Annual cost about $11. $10,000 Insurance, with $50 Weekly Indemnity, at Corresponding Rates. Write or call for Circular and Application Blank.
EUROPEAN PERMITS WITHOUT EXTRA CHARGE.
CHAS. B. PEET (of Rogers, Peet & Co.), Pres't.
JAS. R. PITCHER, Sec'y.
320 & 322 BROADWAY, NEW YORK.



A Wonderful Discovery. IORANIUM will produce handsome moustache or whiskers on the smoothest face in a few weeks. Also promotes the growth of the Hair and Eyebrows. A sure cure for Baldness, Weak, Thin or Falling Hair. 25 cents per package, 3 packages for 50cts, post-paid. C.F. TRAINOR & CO., 75 & 77 Nassau St., New York.

CORNELL UNIVERSITY.

COURSES IN

**Mechanical Engineering
Electrical Engineering
Civil Engineering
and Architecture**

ENTRANCE EXAMINATIONS BEGIN AT 9 A.M. JUNE 18 and SEPT. 18, 1883.

For the UNIVERSITY REGISTER, containing full statements regarding requirements for admission, courses of study, degrees, honors, expenses, free scholarships, etc., and for special information, apply to THE PRESIDENT of CORNELL UNIVERSITY, Ithaca, N.Y.

STEWART'S READY ROOFING

For STEEP and FLAT ROOFS of all kinds; can be applied by ordinary workmen at ONE THIRD the cost of TIN. Send for a sample and our circular which gives full directions how to apply your own roof; also how to repair leaky roofs of all kinds. Address,
W. H. STEWART,
74 Cortlandt St., New York.

50 All New Enameled Gold and Floral Chromo Cards, name on, 10c. W. H. Card Works, West Haven, Ct.

IT PAYS to sell our Hand Rubber Stamps. Samples free. Foljambe & Co., Cleveland, O.

NEW YORK STENCIL WORKS
STEEL LETTERS
STEEL STAMPS
STEEL DIES, &c
100 NASSAU ST. N.Y.

$72 A WEEK, $12 a day at home easily made. Costly Outfit free. Address TRUE & Co., Augusta, Me.

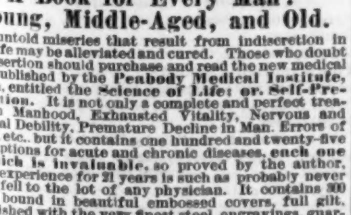
MORPHINE AND WHISKEY

Habits easily cured with my DOUBLE
CHLORIDE OF GOLD
REMEDIES. 5,000 cures. Books FREE.
LESLIE E. KEELEY, M. D.,
Surgeon C. & A. Railroad. Dwight, Ill.

AGENTS can now grasp a fortune. Outfit worth $10 free. Address E. G. RIDEOUT & CO., 10 Barclay St., N. Y.

50 Elegant large chromos, no 2 alike, name on, 10c. present with each order. O. A. Brainard, Higganum, Ct.

MANHOOD!



KNOW THYSELF.

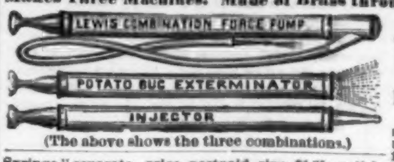
**A Book for Every Man!
Young, Middle-Aged, and Old.**

The untold miseries that result from indiscretion in early life may be alleviated and cured. Those who doubt this assertion should purchase and read the new medical work published by the Peabody Medical Institute, Boston, entitled the Science of Life; or, Self-Preservation. It is not only a complete and perfect treatise on Manhood, Exhausted Vitality, Nervous and Physical Debility, Premature Decline in Man, Errors of Youth, etc., but it contains one hundred and twenty-five prescriptions for acute and chronic diseases, each one of which is invaluable, so proved by the author, whose experience for 21 years is such as probably never before fell to the lot of any physician. It contains 300 pages, bound in beautiful embossed covers, full gilt, embellished with the very finest steel engravings, guaranteed to be a finer work in every sense—mechanical, literary, or professional—than any other work retailed in this country for $2.50, or the money will be refunded. Price only $1.25 by mail. Gold medal awarded the author by the National Medical Association. Illustrated sample sent on receipt of six cents. Send now.

Address PEABODY MEDICAL INSTITUTE, or DR. W. H. PARKER, No. 4 Bulfinch Street, Boston, Mass. The author may be consulted on all diseases requiring skill and experience.

LEWIS' COMBINATION FORCE PUMP.

Makes Three Machines. Made of Brass throughout. My agents are making $5 to $30 per day.

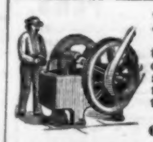


(The above shows the three combinations.)

ANOTHER NEW IMPROVEMENT IS
The Lewis Patent Spray Attachment.
Can change instantly from solid stream to spray.
DON'T FAIL TO READ THIS SPLENDID OFFER.

I will send a sample Pump, express paid, to any express station in the United States or Canadas for $5.50; regular retail price, $6. Weight, 4½ lb.; length, 32 in. I also manufacture the "Potato Bug Exterminator or Agricultural Syringe" separate—price, postpaid, zinc, $1.25; polished brass, $1.75. Send for Illustrated Circular, Price List, and Terms to Agents, etc. I give a long list of customers, each of whom has bought from $50 to $3,000 worth of these goods in from one to three weeks' time. You can make from $10 to $30 per day. Agents wanted everywhere.
P. C. LEWIS, CATSKILL, N. Y.

ROCK BREAKERS AND ORE CRUSHERS.

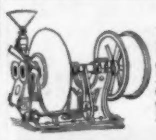


We manufacture and supply at short notice and lowest rates, Stone and Ore Crushers containing the invention described in Letters Patent, issued to Eli W. Blake, June 15th, 1858, together with NEW AND VALUABLE IMPROVEMENTS, for which Letters Patent were granted May 11th and July 20th, 1880, to Mr. S. L. Marsden. All Crushers supplied by us are constructed under the superintendence of Mr. Marsden, who, for the past fifteen years, has been connected with the manufacture of Blake Crushers in this country and England.
FARREL FOUNDRY AND MACHINE CO., Manufrs., Ansonia, Conn.
COPELAND & BACON, Agents, New York.

ICE MAKING MACHINES,

And Machines for Cooling Breweries, Pork Packing Establishments, Cold Storage Warehouses, Hospitals, etc.
SEND FOR ILLUSTRATED AND DESCRIPTIVE CIRCULARS.
PICTET ARTIFICIAL ICE CO. (Limited),
P. O. Box 3083. 142 Greenwich St., New York City, N. Y.

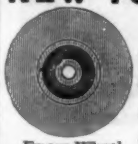
CONTINENTAL WORKS, BROOKLYN, N. Y.
DUC'S MECHANICAL ATOMIZER OR PULVERIZER,



For reducing to an impalpable powder all kinds of hard and brittle substances, such as QUARTZ, EMERY, CORUNDUM, GOLD AND SILVER ORES, BARYTES, COAL, PHOSPHATE ROCK, etc. It is simple and not liable to get out of order, revolving shell being constructed of Siemens-Martin steel, and all parts mechanical in design and of first-class construction. Weight, 5,500 lb.; heaviest piece, 1,500 lb. It will pulverize 7 TO 10 TONS IN TEN HOURS with 30 H. P. For circulars and full particulars, apply to or address
THOS. F. ROWLAND, Sole Manuf'r, Brooklyn, N. Y.

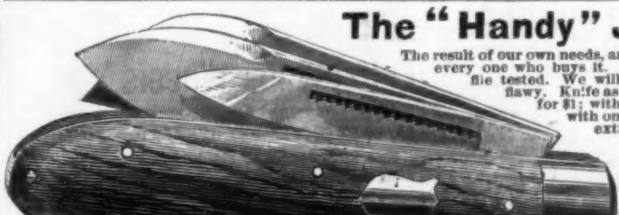
NEW YORK BELTING AND PACKING COMP'Y.

The Oldest and Largest Manufacturers of the Original
SOLID VULCANITE EMERY WHEELS.



All other kinds Imitations and Inferior. Our name is stamped in full upon all our standard BELTING, PACKING, and HOSE.
Address NEW YORK BELTING AND PACKING CO.
JOHN H. CHEEVER, Treas. 29 PARK ROW, NEW YORK.
Emery Wheel.
SPECIAL NOTICE.
Owing to the recent great fire in the "World" Building, our office has been removed as above.

The "Handy" Jack Knife.



The result of our own needs, and a knife that will please every one who buys it. Blades are oil temper and file tested. We will replace free any soft or flawy. Knife as shown in cut sent postpaid for $1; with the two large blades, 75c.; with one large and small blade, 50c.; extra heavy two-blade knife, 75c.; Gents' three-blade, $1. Discount to clubs. 40-page list free. Also "How to Use a Razor."
MAHER & GROSH,
40 Monroe Street,
TOLEDO, OHIO.

HENDERSON'S SPECIAL REFRACTORY COMPOUNDS.

SUBSTITUTES FOR FIRE BRICK.

Costs less than common red brick. Practically infusible. Can be made in any locality where sand is found. No capital for machinery necessary. Any one can handle them. Repairs made by same material. Specially advantageous for Iron, Steel, Silver, and Lead Smelting Works; also for inner walls of FIREPROOF BUILDINGS. For particulars of manufacture and license to use, apply to JAMES HENDERSON, Bellefonte, Penn.

CHASE'S IMPROVED LIQUID GLUE,

For Cementing Wood, Glass, Jewelry, Crockery, Furniture, Leather, Ornaments, and Bric-a-Brac of every description.
Every bottle has a nice Cap and Brush ready for immediate use.
This Glue is packed in 2 oz. bottles, and in screw-top cans, and is warranted not to deteriorate with age, either before or after use. It is a GIANT IN STRENGTH, *economical*, and once carefully tried, you will never be without it.
HOLWAY, WRIGHT & RICH, Sole Agents,
BOSTON, 135 State Street. NEW YORK, 167 Chambers Street. BALTIMORE, 4 Commerce Street.

PEACH CIDER.

Peach Cider is a new discovery. Patented Oct. 25, 1881. You can realize $3 per bushel net for your Peaches at home. SALE PERMANENT AS FLOUR. Rights to Manufacture and Territory for sale. Address
L. P. COBLENTZ, Patentee,
Middletown, Maryland.

CARLETON'S TREASURY OF KNOWLEDGE, THE BEST SELLING BOOK EVER KNOWN. The largest discount. Circulars free. Agents address G. W. Carleton & Co., Publishers, N. Y.

RUPTURE

cured without an operation or the injury trusses inflict by Dr. J. A. SHERMAN'S method. Office, 251 Broadway, New York. His book, with Photographic likenesses of bad cases, before and after cure, mailed for 10c.

$66 a week in your own town. Terms and $5 outfit free. Address H. HALLET & Co., Portland, Me.

LYON & HEALY
State & Monroe Sts., Chicago.
Will send prepaid to any address their
BAND CATALOGUE,
for 1883, 200 pages, 210 Engravings of Instruments, Suits, Caps, Belts, Pompons, Epaulets, Cap-Lamps, Stands, Drum Major's Staffs, and Hats, Sundry Band Outfits, Repairing Materials, also includes Instruction and Exercises for Amateur Bands, and a Catalogue of Choice Band Music.

Agents Wanted. Sells Rapidly. Particulars free. **C 4S 50** S. M. SPENCER, 112 Wash'n St., Boston, Mass.

OPIUM and WHISKY HABITS cured at home without pain. Book of particulars sent free. B. M. WOOLLEY, M.D., Atlanta, Ga.

ROOT'S NEW IRON BLOWER.

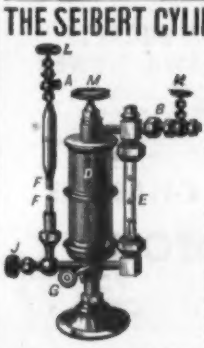
POSITIVE BLAST.
IRON REVOLVERS, PERFECTLY BALANCED,
Has Fewer Parts than any other Blower.
P. H. & F. M. ROOTS, Manufacturers,
CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt., 22 Cortland St., 9 Dey St.,
COOKE & CO., Selling Agts., 22 Cortland Street,
JAS. BEGGS & CO., Selling Agts. 9 Dey Street,
NEW YORK.
SEND FOR PRICED CATALOGUE.

$5 to $20 per day at home. Samples worth $5 free. Address STINSON & Co., Portland, Me.

TIGHT & SLACK BARREL MACHINERY
A SPECIALTY
JOHN GREENWOOD & CO.
ROCHESTER N.Y.

ARTESIAN WELL DRILLING, WELL BORING AND MINERAL PROSPECTING MACHINERY. Portable, low priced, worked by horse, steam or man power. Will procure an abundance of water in earth or rock, anywhere. Send 3c. stamp for catalogue, also names of those wanting water. C. D. Pierce Well Co., 29 Rose Street, New York.

THE SEIBERT CYLINDER OIL CUP CO.,



Sole Manufacturers of Oil Cups for Locomotives, Marine and Stationary Engine Cylinders, under the Seibert and Gates Patents, with Sight Feed.

TAKE NOTICE.
The "Sight Feed" is owned exclusively by this company. See Judge Lowell's decision in the United States Circuit Court, District of Massachusetts, Feb. 23, '82. All parties are hereby notified to desist the use, manufacture, or sale of same, as we shall vigorously pursue and prosecute all infringers.

THE SEIBERT CYLINDER OIL CUP CO.,
53 Oliver Street, Boston, Mass.

STRAIGHT LINE ENGINE CO. SYRACUSE, N.Y.
STRICTLY FIRST CLASS AUTOMATIC ENGINE OF FROM TEN TO SIXTY HORSE POWER

Valuable Manufacturing Property AT AUCTION.

If not sold privately, the undersigned will, on 6th of June, 1883, sell at auction, at Bagg's Hotel, Utica, N. Y., at 2 P.M., the property formerly belonging to the Paris Furnace Company, located at Clayville.

This property consists of two separate mills or shops, one with steam, and each with good water power, full line of shafting, etc.

Attached to the works are shops, offices, residence, and twenty-four acres of land.

They are on the line of the D., L. & W. R. R., ten miles from Utica. Were formerly used for the manufacture of hoes, forks, scythes, etc., but can be readily adapted to any purpose. Taxation light. Coal and labor secured at lowest rates.

The owners will let the property go at a great sacrifice, and to any one desirous of engaging in manufacturing no better location can be found.

If not sold as an entirety, the manufacturing establishments will be offered separately.

Terms, one-third cash; balance on bond and mortgage, at 5 per cent., if desired.

For particulars and description, address
H. C. SHOLES, Att'y at Law,
Clayville, N. Y.

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERN
FINE TINNING JAPANNING AND FINISHING
THOMAS DEVLIN & CO.
LEHIGH AVE & AMERICAN ST. PHILA

UNIVERSAL

The Newell MILL.
Pulverizes everything—hard, soft, gummy, etc. The best Clay Grinder and the best Cotton Seed Huller in the world.
Portable Steam Engines, Stationary Engines, Horizontal and Upright Boilers, all sizes, on hand for immediate delivery.
10 Barclay St., N. Y. City.

Pat. Jan. 20, '75. Pat. July 27, '75.
THE
Shimer Cutter Heads
10,000 SOLD.
To work Car Siding, Flooring, Ceiling, and Ship Lap. To Mould Doors, Sash, and Blinds. Cope Heads to match.
Shimer & Co.,
Milton, Pa.
Re-issued Oct. 12, '80. Pat. July 18, '82.

FOR SALE OR RENT.

To manufacturers: I have one of the finest manufactories in the West, with a capacity of 40,000 square feet of floor space, equipped with gas, hydrant water, 100 horse power engine, two boilers, elevators, benches, shafting, etc., at Grand Crossing, just outside the city limits of Chicago. Over 100 passenger trains a day between Chicago and Grand Crossing. For further particulars, apply to
W. G. WILSON,
255 and 257 Wabash Av., Chicago, Ill.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W. 29 ST. NEW YORK CITY

Wanted, a First-Class Superintendent
FOR A
Western Foundry and Machine Shop,

At present employing 400 hands. To one who has had a thorough experience in the manufacture of Corliss Engines and General Machinery, and who is competent to take charge of the entire manufacturing department, steady employment guaranteed. Must give satisfactory reference stating experience, etc. Apply by letter to JOHN SMITH, care W. T. Davidson,
41 to 47 Keap St., Brooklyn, N. Y.

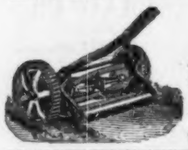
Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

COLUMBIA BICYCLE.
This easy running, staunch, and durable roadster is the favorite with riders, and is confidently guaranteed as the best value for the money attained in a Bicycle. Send 3c. stamp for 36-page Catalogue, containing price list and full information.
THE POPE M'F'G CO., 597 Washington St., Boston, Mass.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 Walnut St., Philadelphia.
Our stock comprises the literature of every branch of science applied to the arts. Catalogues free to any address in the world.

Books on Steam and the Steam Engine.
JUST PUBLISHED.
A Catalogue of Books on Steam and the Steam Engine, Mechanics, Machinery, and Dynamical Engineering, for sale by us, will be sent free, and free of postage, to any one in any part of the world who will furnish his address.
HENRY CAREY BAIRD & CO., Industrial Publishers, Booksellers, and Importers, 810 WALNUT STREET, PHILADELPHIA, PA.

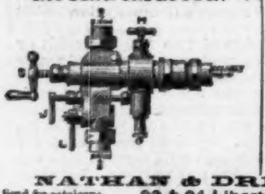


"BUCKEYE" LAWN MOWER.
The lightest and easiest running Mower ever made. STRICTLY FIRST CLASS.
MAST, FOOS & CO., Springfield, Ohio.
Send for catalogue.

A GRAND CHANCE TO MAKE MONEY.
Write to J. R. BEALE, of Rush Centre, Kansas, for particulars. All persons interested in harvesting broom corn should try his patented method of cutting and preparing it. State rights for sale, or the entire patent can be bought at a low figure considering the value of the invention.

ROOFING
PEERLESS BRAND
A PERFECT JOINT
SEND FOR ESTIMATES AND SAMPLES
NEW YORK COAL TAR CHEMICAL CO. 10 WARREN ST N.Y.

The "MONITOR." A NEW LIFTING AND NON-LIFTING INJECTOR.

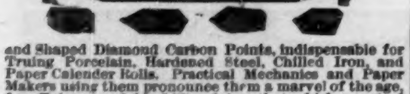


Best Boiler Feeder in the world. Greatest Range yet obtained. Does not Break under Sudden Changes of Steam Pressure.
Also Patent **EJECTORS** or **Water Elevators**, For Conveying Water and Liquid. Patent Oilers, Lubricators, etc.
NATHAN & DREYFUS, Send for catalogue. 92 & 94 Liberty St., New York.

H.W.JOHNS' ASBESTOS
ASBESTOS ROPE PACKING,
ASBESTOS WICK PACKING,
ASBESTOS FLAT PACKING,
ASBESTOS SHEATHINGS,
ASBESTOS GASKETS,
ASBESTOS BUILDING FELT.
Made of strictly pure Asbestos.
H. W. JOHNS M'F'G CO.,
87 Maiden Lane, New York,
Sole Manufacturers of H. W. Johns' Genuine
ASBESTOS LIQUID PAINTS, ROOF PAINTS, ROOFING, STEAM PIPE AND BOILER COVERINGS, FIREPROOF COATINGS, CEMENTS, ETC.
Descriptive price lists and samples free.

CROWELL MANUFACTURING CO.
Greencastle, Penn.,
Manufacturers of Engines, Boilers, and Saw Mills. Stationary Engines for Mills and Factories. Grain and Fertilizer Drills a specialty. Correspondence solicited.

LITTLE WONDER.



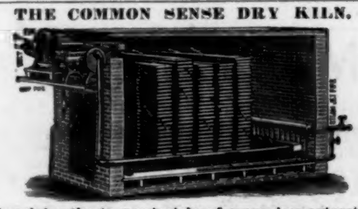
and Shaped Diamond Carbon Points, indispensable for Truing Porcelain, Hardened Steel, Chilled Iron, and Paper Calender Rolls. Practical Mechanics and Paper Makers using them pronounce them a marvel of the age, for efficiency and durability, doing that which no steel tool can do. After turning the Rolls, when inspected by a microscope, there is no perceptible wear. They are now extensively used in Rolling and Paper Mills, both in this country and in Europe. Send stamp for circular to JOHN DICKINSON, 64 Nassau Street, New York.

Clark's Noiseless Rubber Wheels. Absolutely prevent splintering and wearing of floors caused by use of Iron Wheels. Adapted for Trucks, Boxes, Baskets, Tables, and work of every kind in Mills, Warehouses, Stores, etc. Catalogue free.
GEO. P. CLARK, Windsor Locks, Ct.

Is acknowledged by users as the *Best* in the world. Unlike all other Packings, the **Jenkins Standard Packing** can be made any thickness desired in a joint by placing two or as many thicknesses together as desired, and following up joint it vulcanizes in place and becomes a metal of itself (it is frequently called Jenkins Metal) and will last for years, as it does not rot or burn out. Avoid all imitations. The GENUINE has stamped on every sheet "JENKINS STANDARD PACKING," and is for sale by the trade generally. ☞ Send for Price List "B."

ONE THOUSAND TONS METALLIC SHINGLES
Are now being used by the W. S. and B. R. R. on depots between New York and Buffalo.
Manufactured by the
ANGLO-AMERICAN ROOFING CO.
22 CLIFF STREET, NEW YORK,
And 221 Dudley Road, Wolverhampton, Eng.

THE COMMON SENSE DRY KILN.



In solving the true principle of seasoning, extracting the sap from the center by suction, rapid circulation of air, with moderate heat, we offer the cheapest kiln in construction, quickest in operation, and perfect in results. Prevents checks, warp, or hardened surface.
ST. ALBANS M'F'G CO., St. Albans, Vt.

NUT TAPPING MACHINE.
DURRELL'S PATENT.
No. 1 Machine, 900 lb., 7 spindles.
" 2 " 1,050 " 7 "
" 2 " 600 " 3 "
Capacity of 7 Spindles, 8,000 per 10 hours.
Acknowledged to be an indispensable tool. Manufactured by
HOWARD BROS., Fredonia, N. Y.

WM. A. HARRIS,
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements, from 10 to 1,000 H. P.

EVAPORATING FRUIT

American Fruit Drier.

Treatise on improved methods SENT FREE. Wonderful results. Tables of Yields, Prices, Profits, and General Statistics. Address
AMERICAN MANUF'G CO., Waynesboro, Pa.

The Double Induction Electric Motor
For Family Sewing Machines, Dental, Jewelers', Watchmakers' Lathes, Fans, etc. Motor, with automatic battery and complete outfit for sewing machine, $35 to $40. THE ELECTRO-DYNAMIC CO. OF PHILA., 121 So. 3d St., Phila. 19 E. 15th St., New York. Cannon St., London, Eng. In writing for catalogue, give street and number.

ELECTRIC LIGHT TELEPHONE & TELEGRAPH SUPPLIES
WALLACE DIAMOND TRADE MARK
THE ELECTRICAL SUPPLY Co. 109 LIBERTY ST. NEW YORK

SPEAKING TELEPHONES.
THE AMERICAN BELL TELEPHONE COMPANY,
W. H. FORBES, *President.* W. R. DRIVER, *Treasurer.* THEO. N. VAIL, *Gen. Manager.*
Alexander Graham Bell's patent of March 7, 1876, owned by this company, covers every form of apparatus, including Microphones or Carbon Telephones, in which the voice of the speaker causes electric undulations corresponding to the words spoken, and which articulations produce similar articulate sounds at the receiver. The Commissioner of Patents and the U. S. Circuit Court have decided this to be the true meaning of his claim; the validity of the patent has been sustained in the Circuit on final hearing in a contested case, and many injunctions and final decrees have been obtained on them.
This company also owns and controls all the other telephonic inventions of Bell, Edison, Berliner, Gray, Blake, Phelps, Watson, and others.
(Descriptive catalogues forwarded on application.)
Telephones for Private Line, Club, and Social systems can be procured directly or through the authorized agents of the company.
All telephones obtained except from this company, or its authorized licensees, are infringements, and the makers, sellers, and users will be proceeded against.
Information furnished upon application.
Address all communications to the
AMERICAN BELL TELEPHONE COMPANY, 95 Milk Street, Boston, Mass.

WESTCOTT'S Chucks
WARRANTED SUPERIOR TO ANY IN THE WORLD
In capacity, strength, durability, and convenience.
Oneida Steam Engine and Foundry Company,
Send for Price List. ONEIDA, N. Y.

ERICSSON'S New Caloric Pumping Engine,
FOR **Dwellings & Country Seats**
Simplest! Cheapest! Economical! Absolutely Safe!
Delamater Iron Works,
C. H. Delamater & Co., Proprietors,
10 Cortlandt Street, New York, U. S. A.

ESTABLISHED 1841.
JOHN HOLLAND,
Manufacturer of **GOLD PENS,**

Pen Holders, Pencil Cases, MacKinnon Stylographic and Elastic Fountain Pens. Over one million of our Gold Pens now in use, many of them more than twenty years old. If not sold by your stationer or jeweler, send for illustrated price list to 19 West 4th St., Cincinnati, O.

PATENT **JACKET KETTLES,**
Plain or Porcelain Lined. Tested to 100 lb. pressure. Send for Lists.
JAMES C. HAND & CO., 614 and 616 Market St., Philadelphia, Pa.

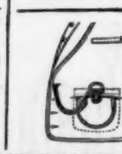
BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

Best Boiler and Pipe Covering Made!

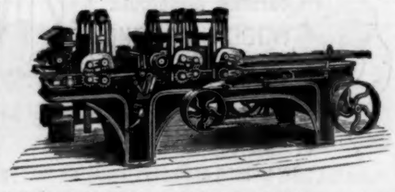
The Celebrated Patent Air Space COVERING
For STEAM BOILERS and PIPES, HOT BLAST PIPING, etc., etc. Address CHALMERS SPENCE CO., 23 John Street, New York.

VERTICAL ENGINES
THE BEST IN THE MARKET AT REASONABLE PRICES
MANUFACTURED BY
PHOENIX FOUNDRY & MACHINE CO
SYRACUSE N.Y.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer, 149 Broadway, New York.



The AUTOMATIC POCKET Adjusts itself in the pocket; no trouble; excludes dust; holds the watch secure; protects the case from denting, scratching and wearing. *Every person having a watch should have one.* The only reliable watch pocket. Sent for 30c. by the **Automatic Pocket Co.** 517 Market St., Philadelphia, Pa. *State size of watch.* Agents wanted.



WITHERBY, RUGG & RICHARDSON. Manufacturers of Patent Wood Working Machinery of every description. Facilities unsurpassed. Shop formerly occupied by R. Ball & Co., Worcester, Mass. Send for Catalogue.

Leffel Water Wheels,

With Important Improvements.
11,000 IN SUCCESSFUL OPERATION.
FINE NEW PAMPHLET FOR 1883
Sent free to those interested.
JAMES LEFFEL & CO., Springfield, Ohio.
110 Liberty St., N. Y. City.

PATENT COLD ROLLED SHAFTING.
The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS, Try Street, 2d and 3d Avenues, Pittsburg, Pa. Corner Lake and Canal Sts., Chicago, Ill.
☞ Stocks of this shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass. Geo. Place Machinery Agency, 121 Chambers St., N. Y.

The Mines of the Carolinas Use Van Duzen's Patent Steam Jet Pump. Far superior to any other Jet Pump for practical service. Made of Brass; has no valves, no moving parts, no small openings. Will pump Dirty, Sandy, Gritty, Hot, or Cold Water. Will raise water to 50 feet vertically. Can be used with hose. Warranted reliable and satisfactory. Prices from $7 up. Capacities 300 to 20,000 gal. per hour. Demand this pump and take no cheap substitute.
Send for "Catalogue No. 49."
VAN DUZEN & TIFT, Cincinnati, O.

COE BRASS MFG. CO
TORRINGTON — CONN.
BRASS AND COPPER IN SHEETS
MATERIALS FOR METALLIC AMMUNITION A SPECIALTY
WIRE AND BLANKS

NEW HAVEN MANUFACTURING CO.
NEW HAVEN, CONN.,
MANUFACTURERS OF IRON WORKING
MACHINE TOOLS
Lathes, Planers, Drills, Shapers, etc.
ILLUSTRATED CATALOGUE ON APPLICATION.

F. Brown's Patent **FRICTION CLUTCH.**
Send for Illustrated Catalogue and Discount Sheet to
A. & F. BROWN, 43 Park Place, New York.
SHAFTS PULLEYS HANGERS

Establ'd EAGLE ANVILS. 1843.
Solid CAST STEEL Face and Horn. Are Fully Warranted. Retail Price, 10 cts. per lb.

KORTING UNIVERSAL INJECTOR
DOUBLE TUBE.

FOR BOILER FEEDING.
Operated by one handle.
WILL LIFT HOT WATER.
POSITIVE ACTION GUARANTEED UNDER ALL CONDITIONS.
NO ADJUSTMENT FOR VARYING STEAM PRESSURE.
WILL LIFT WATER 25 FEET. SEND FOR DESCRIPTIVE CIRCULAR.
OFFICES AND WAREROOMS:
PHILADA., 12TH & THOMPSON STS.
BOSTON, 7 OLIVER ST.
AUGUSTA, GA., 1026 FENWICK ST.
DENVER, COL., 438 BLAKE ST.
RICHMOND, VA., 1419 MAIN ST.
NEW YORK, 109 LIBERTY ST.
CHICAGO, 84 MARKET ST.
ST. LOUIS, MO., 709 MARKET ST.
SAN FRANCISCO, 2 CALIFORNIA ST.

HARTFORD STEAM BOILER Inspection & Insurance COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

PAYNE'S AUTOMATIC ENGINES.

Reliable, durable, and economical, *will furnish a horse power with one-third less fuel and water than any other engine built, not fitted with an automatic cut-off.* Send for Illustrated Catalogue "A 2" for information and prices. **Box 1207**
B. W. PAYNE & SONS, Corning, N. Y.

VOLNEY W. MASON & CO.,
FRICTION PULLEYS, CLUTCHES, and ELEVATORS,
PROVIDENCE, R. I.

NATIONAL TOOL CO.,
MANUFACTURERS OF
MACHINISTS TOOLS.
WILLIAMSPORT. PA.
PLANERS A SPECIALTY.

Steel Castings
From ¼ to 15,000 lb. weight, true to pattern, of unequaled strength, toughness, and durability. 20,000 Crank Shafts and 15,000 Gear Wheels of this steel now running prove its superiority over other Steel Castings. Send for circular and price list.
CHESTER STEEL CASTINGS CO., 407 Library St., Philadelphia, Pa.

SCIENTIFIC AMERICAN
FOR 1883.
The Most Popular Scientific Paper in the World.
Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in the SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

One copy of the SCIENTIFIC AMERICAN and one copy of the SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of *seven dollars* by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO., 261 Broadway, New York.

PRINTING INKS.
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts. Phila., and 47 Rose St., opp. Duane St., N. Y.